

I.

Comparative Biology of Salticid Spiders at Rancho Grande, Venezuela.

Part I. Systematics and Life Histories in *Corythalia*.¹

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(Plate I; Text-figures 1-15).

[This is one of a series of papers resulting from the 45th and 46th Expeditions of the Department of Tropical Research of the New York Zoological Society, made during 1945 and 1946 under the direction of Dr. William Beebe with headquarters at Rancho Grande in the National Park of Aragua, Venezuela. The expeditions were made possible through the generous cooperation of the National Government of Venezuela and of the Creole Petroleum Corporation.

The characteristics of the research area are in brief as follows: Rancho Grande is located in north central Venezuela ($10^{\circ} 21' N.$, Lat., $67^{\circ} 41' W.$ Long.), 80 kilometers west of Caracas, at an elevation of 1,100 meters in the undisturbed montane cloud forest which covers this part of the Caribbean range of the Andes. Adjacent ecological zones include seasonal forest, savanna, thorn woodland, cactus scrub, the fresh water Lake Valencia, and various marine littoral zones. The Rancho Grande area is generally subtropical, being uniformly cool and damp throughout the year because of the prevalence of the mountain cloud cap. The dry season extends from January into April. The average humidity during the expeditions, including parts of both wet and dry seasons, was 92.4%; the average temperature during the same period was $18^{\circ} C$; the average annual rainfall over a 5-year period was 174 cm. The flora is marked by an abundance of mosses, ferns and epiphytes of many kinds, as well as a few gigantic trees. For further details, see Beebe & Crane, *Zoologica*, Vol. 32, No. 5, 1947. Unless otherwise stated, the specimens discussed in the present paper were taken in the montane cloud forest zone, within a radius of 1 kilometer of Rancho Grande.]

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INTRODUCTION.

Jumping spiders are among the most interesting of all animals for two distinct reasons. First, the epigamic displays and associated

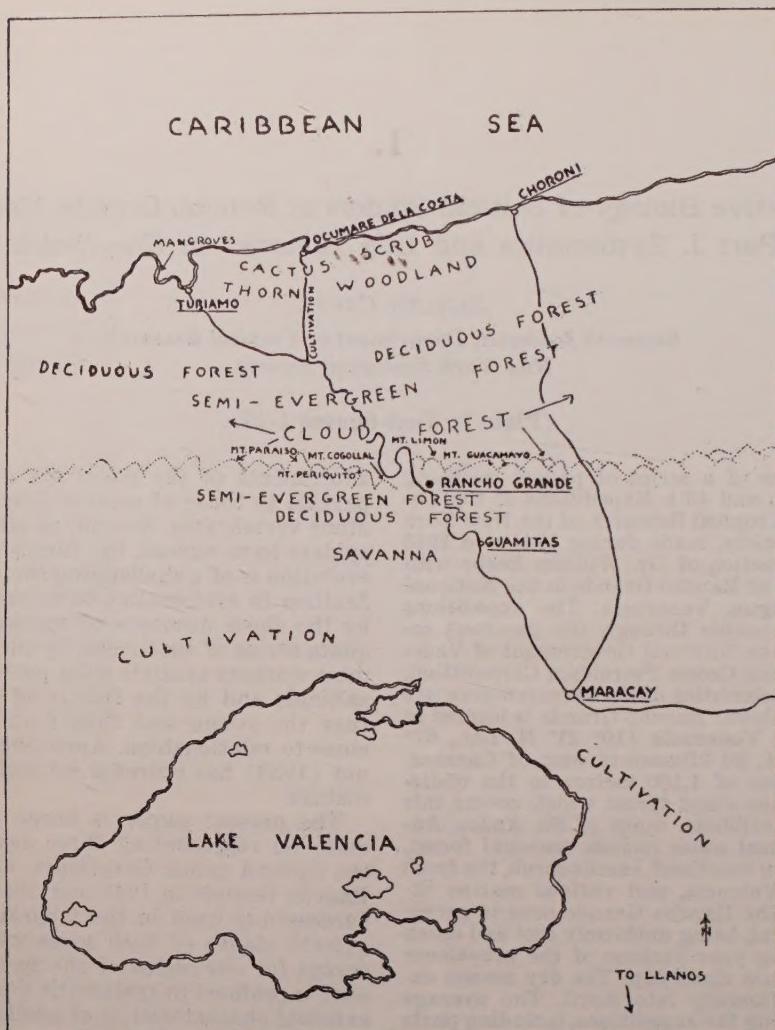
adornments of the males are directly comparable to those of certain fishes, birds and other vertebrates. Second, as all students of spiders have agreed, the family's pattern of evolution is of a challenging complexity. Difficulties in systematics have been increased by the sheer numbers of species, by inadequate series of specimens, by the inability of most workers to study color pattern in living salticids and by the failure of attempts to rear the young and thus gain ontogenetic clues to relationships. Apparently only Bonnet (1933) has reared a salticid through all instars.

The present paper is based on plentiful material representing three new species of the salticid genus *Corythalia*, all studied at Rancho Grande in 1945 and 1946. Each was successfully bred in the laboratory, and all growth stages of both sexes were obtained except for one instar of one species. The report is confined to systematic descriptions of external characteristics of adults and young, accounts of normal display and general life history data. A subsequent paper will present an analysis of display, based both on normal display and on experimental work, and a discussion of evolutionary trends as suggested by development of color and structure, and by behavior. Also to follow is an account of culture and display-study methods.

During the first season at the Rancho Grande station, growth stages and displays of more than forty other species of salticids were also studied in more or less detail. The second year concentrated work was confined to half a dozen of these forms, including *Corythalia*, so that more complete life histories could be obtained and experimental work accomplished.

The three local species of *Corythalia* were among those chosen for special study for the following reasons: first, material of all three species was plentiful and thrived under laboratory conditions; this gave a unique opportunity for comparisons of development, behavior and species barriers in closely related forms. Second, *Corythalia* proved to be highly specialized in many characteristics, particularly in color development and display behavior, and so is an important group for

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TEXT-FIG. 1. General location of the principal ecological zones near Rancho Grande. The *Corythalia* described in the present paper were taken only in the semi-evergreen and lower cloud forest slopes of the southern watershed. Although only the highest ridge of the coastal range is indicated, the entire region is mountainous except for the Lake Valencia plain.

the study of evolutionary trends, both inside the genus and in comparison with other salticids.

The drawings of *Corythalia* display and the frontal views of females (Text-figs. 12, 13, 14 (part), 15) were made from life by Mr. Kenneth Gosner at Rancho Grande; he also made the preliminary drawings for the growth stage patterns (Text-fig. 2). The final forms of Text-figs. 2 and 14 and the remaining drawings are the work of Miss Pamela Marmont.

The measurement and spine notation systems used are those proposed by Dr. Alexander Petrunkevitch, as outlined in his "Study of Amber Spiders" (1942, pp. 135-139). The standard abbreviations AME, ALE, PME and PLE are used throughout for the various eyes, antero-median, antero-lateral,

postero-median and postero-lateral, respectively. "Instar" and "stadium" are used interchangeably. Unless otherwise stated averaged measurements are from five specimens of each sex or instar considered; length measurements and spine counts include all specimens.

I wish especially to thank Sr. Pedro Infante and Sr. Eduardo Echenagueio, laboratory assistants at Rancho Grande, for their invaluable help in collecting and tending the living salticids.

Deep appreciation goes to Dr. William Beebe and to Dr. Alexander Petrunkevitch for their constructive advice and encouragement.

The types are deposited in the collections of the Department of Tropical Research, New York Zoological Society, New York 60, N. Y.

CHARACTERISTICS OF THE GENUS *CORYTHALIA* WITH SPECIAL REFER- ENCE TO THREE SPECIES.

ADULT FORM AND POST-EMBRYOLOGICAL DE- VELOPMENT OF EXTERNAL CHARACTERISTICS.

More than fifty species have hitherto been referred to the American genus *Corythalia*, originally and in synonymy. Several species occur in the United States, but most have been taken in Central America and the West Indies. The few recorded South American forms, all known only from the original series, are the following: From Colombia, *C. dimidiata* Simon, 1901 (color note only), and *C. electa* (Peckham, 1900); from Trinidad (a biological part of South America, rather than of the West Indies), *C. blanda* and *C. placata* (both Peckham, 1900); from French Guiana *C. heliophanina* (Taczanowski, 1871); and from Brazil, *C. fimbriata* and *C. valida* (both Peckham, 1900). Simon, 1901, p. 655, indicated that he took the genus also in the Andes of Venezuela and Ecuador, but descriptions have apparently never been published. Without question, many more South American species remain to be taken and described; our own collections contain at least three more species, in addition to the three with which the present paper is concerned, from other parts of Venezuela and from British Guiana.

It seems equally certain that when adequate knowledge of the group is attained, some of the species in the genus will be reduced to geographical subspecies, or even merged in geographical clines. On the other hand, since the group is obviously subject to high speciation and a radiative type of evolution, it will always remain difficult to divide systematically. As in the family in general, certain characters are present in widely separated species, and absent in closely related ones, while others vary without sharp boundaries.

As is the case with so many salticid genera, the delimitation and understanding of *Corythalia* are complicated by six factors. First, the limits of the genus are apparently not sharply definable. Second, no general survey of the group has been undertaken, to include the extensive series of species now known from both Panama and the West Indies, as well as earlier material from Central and South America. Third, many of the species now referred to this genus are inadequately known, or have been described from a single sex. Fourth, the color and appearance in life have only rarely been recorded. Fifth, the display has not hitherto been described. Sixth, and finally, the post-embryological development has not been previously studied.

Although the present study makes no attempt to review the genus, the following survey of the three new species proposed in this paper should be of aid in a future review of the group. Comparison of these gen-

eral structural characteristics with those given by recent workers in the group, notably Chickering (1946) and Bryant (1942 ff.) show that they are also typical of many Panamanian and West Indian species of *Corythalia*. Some characteristics, in fact, often mentioned in specific descriptions, are shared by many other salticids; examples are the arrangements of facial bristles and trichobothriae. Nevertheless, the data in this paper are based only on the three species to be described, since the earlier authors do not give sufficient data in comparable form to permit complete comparison.

The present survey is given in order to eliminate repetition in the actual specific descriptions, which begin on p. 14, and to form a foundation for the eventual general survey. A résumé of the post-embryological development of each character is given under each.

Two of the proposed species, *chalcea* and *fulgipedia*, are closely related, while the third, *xanthopa*, apparently belongs to a different branch of the genus *Corythalia*. All are characteristic, not borderline, species. For these reasons, a detailed comparison of the three yields enlightening information in regard both to similarities and to directions of variation in the group.

Included in the preliminary discussion are descriptions of the general developmental, behavioristic and ecological characteristics of the three species. Discussion and comparison are reserved for final sections on an Analysis of Display and on Phylogeny, to be published later.

In brief, the three species fit into Chickering's diagnosis of the "Phiale group" (1946, p. 34) and of *Corythalia* as given (*ibid.*, p. 112). The retromargin of the chelicera in all our species has a single small tooth (present or absent in other genus members); definite fringes present on the first three or all four legs (present or absent in other genus members); total eye space occupying about half length of carapace; PME slightly closer to PLE than to ALE; lateral sides of carapace nearly vertical and nearly parallel; anterior coxae further apart than width of base of lip; ventral spines on first tibia 1r-2-2, 0-1r-2 or 0-0-2, not, as is more usual in the previously described species, 2-2-2.

The various characters and their development will now be considered in detail.

Color in Life: Adults. Integument jet black except for light brown third and fourth, or all, tarsi. A few dark bristles on carapace, described below. Carapace with or without submarginal band and thoracic markings of white scales; ocular quadrangle with or without bronze scales; anterior eyes brownish-black, usually with deep green reflections, always rimmed with yellow or rusty scales; clypeus, chelicerae and palps with or without white or yellow scales and hairs. Palps and legs with plentiful black hairs; male leg fringes black, except for yellow fourth dorsal fringes in *xanthopa*; leg iridescence chiefly purple; white or yellowish

leg scales present in varying amounts in both sexes, better developed in female. Abdomen with transverse bars of black and yellow or white scales (represented subdermally by dark and pale integument) and a pair of terminal spots, all more or less overlaid in males with bronze or yellow scales, or, in female *xanthopa*, with two yellow stripes; dark hairs and bristles arising above scales. This general range of coloration is typical of previously described species in the genus, except that red, occasionally found on faces and abdomens, does not occur in these three species. Sexual dimorphism in color ranges from slight to extreme.

Young. Integument: Pigment absent in first instar, which is translucent with a faint greenish or yellow cast; late in this stadium the pale abdominal bands of the second are faintly visible, since the entire spiderling now has a gray tinge from the black cuticle developing subdermally; radiating lines appear on thoracic region. Second instar integument of carapace and abdomen jet black, except for the two pale abdominal bands, one in anterior third, the other behind middle, and a pair of terminal spots; by this stage, too, pigment may or may not be developing in bands on legs; the latter gain full pigment, except for feet, between fourth and sixth stadia, the palps a stage or two later.

Scales: Even in second instar, abdominal bands and spots are completely covered with white or yellow scales and intervening portions with black; these primary markings persist throughout at least preadult instar and along with black integument are the most characteristic features of the young compared with those of other genera. A few black scales appear on sides of carapace about the fourth instar, but are usually absent in adult. The most characteristic carapace markings are two spots of white or yellow scales behind PME and a similar pair, or a complete cross-bar, behind PLE; these markings, varying with the species, appear in second or third instar and are traceable at least until sixth; usually they are degenerating and overlaid with bronze scales by the fifth. A strong submarginal band of white scales, characteristic among these three only of *fulgipedia*, appears in third instar; never strong in the other species, it does not appear there until the sixth. AME first rimmed with orange or yellow in second instar, ALE in third or fourth. White scales of face, mouthparts and legs almost absent in *xanthopa*, the yellow frontal hairs of male appearing in rudimentary fashion in preadults of both sexes; white face and appendage scales of the other two species appear in early instars, and are best developed in adult or preadult females.

Color in Alcohol: Even after only a few months in 70% alcohol, the distinct color patterns of these spiders are more or less obliterated, and drying the specimens only partially restores them; bronze and gold become dull brown; silvery white scales fade

to gray or creamy; many of the most characteristic scale patches or bars are missing altogether, iridescence cannot be accurately described; finally different individuals fade and lose their scales to very different extents and this effect of preservation, combined with the normal individual variation in size, structure and pattern, and with sexual dimorphism, would make classification of a few preserved specimens exceedingly difficult; the tendency would be to divide the group into more than the actual number of species. The most constant feature is the light colored second abdominal band, which, since it is well-marked subdermally, is usually traceable in all three spiders. It cannot be emphasized too strongly that color descriptions should be made from large series of living, displaying specimens, with the detail filled in from anaesthetized individuals, and both fresh and worn examples included.

Carapace, General Aspect (Table I)
Adults. Breadth 7/10 to 3/4 of carapace length in both sexes of all three species the carapace being slightly longer in females than males and therefore relatively narrower; extra relative length of female carapace almost altogether in postocular region. Greatest width either at insertion of second leg (*fulgipedia* always, *chalcea*, sometimes), or at the slight bulge always present before PLE. Height a little greater or less than width, about one-half to three-fifths of length, least in *fulgipedia*, most in *xanthopa*; females slightly lower than males. Profile rises gently from AME to PLE; from here it either extends as a plateau or descends gently to a point midway between PLE and posterior border; posteriorly the descent is abrupt; postocular plateau best developed in *fulgipedia*; thoracic slope most abrupt in *chalcea*. A shallow transverse, median depression between posterior borders of PLE and a short, median, longitudinal thoracic groove beginning at bottom of depression and extending slightly beyond it. Length of ocular quadrangle about three-fifths to two-thirds of its breadth, and about two-fifths length of carapace; breadth of quadrangle relatively widest in *xanthopa*.

Young (Text-figs. 3, 4). Form of carapace changing abruptly from relatively higher and broader than adult in first stadium to much lower and flatter than final form in the second. The final general carapace proportions of the female are almost or quite attained by both sexes in fifth instar, the male keeping female height and breadth proportions until adult (7th) stadium. Text-fig. 3 shows that specific differences in carapace profile are apparent even in second instar, *fulgipedia* being lowest with a longer and flatter postocular plateau. Ocular quadrangle in first stages is wider across its anterior margin than in adult.

Eyes (Table I): **Adults.** Anterior row viewed from the front, recurved so that straight line from dorsal borders of AME cuts off one-fourth to one-third of ALE

Anterior row less than one-tenth wider than posterior row. Small eyes inserted at or slightly behind middle of distance between ALE and PLE, opposite middle of lens of corresponding PLE, making middle row almost as wide as posterior. PLE occupying about 80-95% of width of carapace at their level, that extent of variation being found in *fulgipedias*; in the other two species it is more than 90%. AME separated from one another by less than 8% of their diameter, from ALE by slightly more. Diameter of AME between about one-sixth and one-fifth of carapace length; ALE between three-fifths and seven-tenths diameter of AME; PLE large, nine-tenths, more or less, diameter of ALE. Eyes similar in size in all three species, but slightly larger, compared with carapace and AME, in *xanthopas*, and smallest in *fulgipedias*. The slightly larger size of male eyes shown in Table is due principally to slightly shorter male carapace.

Young. Eyes apparently scarcely or not at all functional in first stadium, which is passed in cocoon; there are rudimentary lens-like markings on integument only in front of middle of subdermal AME; large, clear spaces indicate location of other eyes; AME are best indicated, PME scarcely distinguishable. In second instar all eyes are well developed, and in almost adult positions and proportions; however PME appear more definitely behind middle of ocular quadrangle and all are slightly larger relatively than in adult until after fifth instar; also, ALE through second and third stadia are larger than later, even when compared with AME. The relative size is never exaggerated, however, to the extent often found in other animal groups, such as fish and crabs. With growth, the ALE become more recurved.

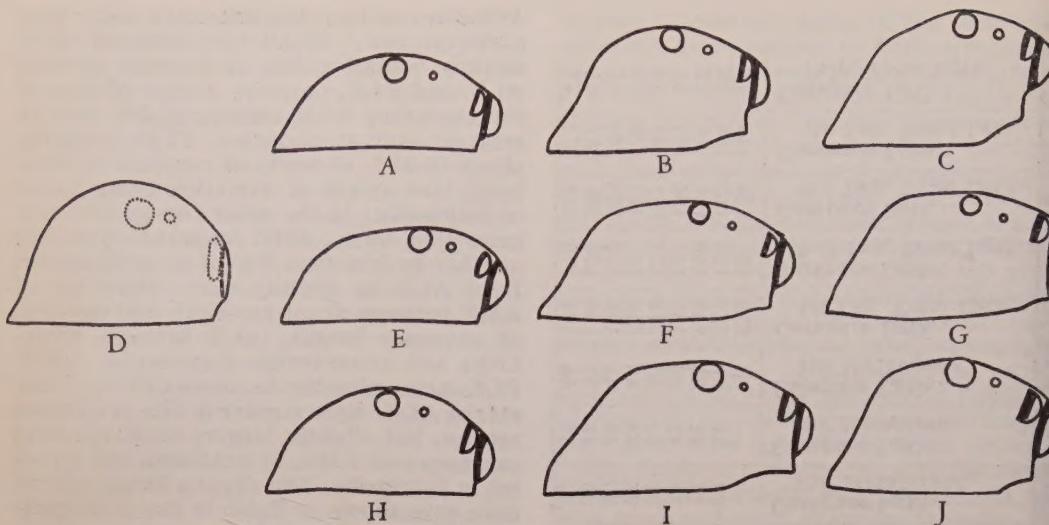
Clypeus: Height slightly less than to slightly more than half diameter of AME in adults and young, but least in second stadium. This is an unsatisfactory measurement; in life the marginal membrane is firm and black, making the clypeus appear broader.

Chelicerae (Text-fig. 5): Adults. Vertical, parallel, not produced; in male moderately robust, in female exceedingly so. Fang short, groove with soft promarginal ridge bearing a row of stiff black bristles, with or without two minute teeth, close together, near inner edge of bristle row; a single tooth, scarcely larger, along middle of retromargin.

Young. I have been unable to detect the retromarginal tooth before the sixth instar. Fang not exserted in first stadium. Chelicerae length slightly longer relatively in second stadium than later.

Maxillæ (*Text-fig. 5*): *Adults and Young.*
Slightly convergent; twice, or scarcely more than twice, as long as wide; outer margin more or less concave, moderately dilated distally; outer distal corner with a blunt, projecting tubercle well developed or scarcely discernible.

Lip (Text-fig. 5): *Adults and Young.*



TEXT-FIG. 3. Change in carapace profile in *Corythalia*. **A-C**, *chalcea*: **A**, 2nd instar; **B**, adult ♀; **C**, adult ♂. **D-G**, *fulgipedia*: **D**, 1st instar; **E**, 2nd instar; **F**, adult ♀; **G**, adult ♂. **H-J**, *xanthopa*: **H**, 2nd instar; **I**, adult ♀; **J**, adult ♂. Profile of 1st instar practically identical in all species. Adult females drawn to same scale as adult males, to show difference in relative size.

Slightly longer than width at base; basal excavations reaching about two-fifths of length; general shape nearly triangular from distal end of excavations; tip reaches three-fifths of distance to tip of maxillae. Sternal suture slightly procurved.

Sternum (Text-fig. 5): *Adults*. Broadly scutiform; width in males three-fourths to four-fifths, in females two-thirds to four-fifths of length; almost as wide or slightly wider at anterior border at base of lip; lateral margins with four excavations on each side well or scarcely developed; widest portion opposite posterior side of second legs; posterior end variable, truncated or bluntly rounded, not extending between fourth coxae, which are separated by about one-fifth to one-seventh of their width.

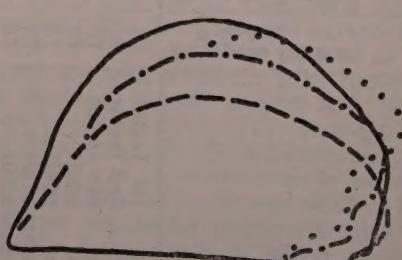
Young. Sternum in first instar almost as broad as long (92%); 77% in second instar; flatter in front and more pointed behind.

Legs. General Proportions (Tables I, VII): *Adults*. In all three species the third and fourth legs are almost equal and are longer than the first and second, which are also of similar length. They are only slightly longer in males than in females, their actual differences being slightly less than appear in Table I, since the male carapace is shorter than that of the female. In both sexes the third and fourth contrast with the first and second in having shorter patellae but longer metatarsi. Tibial index: first leg, males 23 to 27, females 24 to 33; fourth leg, males 17 to 21, females 18 to 27. Legs are relatively shortest and stoutest in *fulgipedia*.

Young (Table VII). Even in the first stadium the legs show these general proportions of the adult, the first two legs being

shorter than the last two; they are much more nearly equal, however, and they measure three-fourths of their adult length in respect to length of carapace. Their tibial index is greater: 27 to 32 (first leg) and 28 to 31 (fourth leg) in the first instar; 24 to 31 (first leg) and 22 to 27 (fourth leg) in the second. The divisions between patella and tibia, and between metatarsus and tarsus, are scarcely discernible in the first stadium, and feebly so in the second in all four legs and the palps. The feet and patellae are noticeably longer in the earliest stages, while the metatarsus elongates chiefly from the fifth instar onward.

Iridescence: In adult male only present prolaterally on patella, tibia and metatarsus in all three species in the same relative strengths, being strongest on tibia and metatarsus; it is present on at least the first three legs, in the following relative strengths: 3, 2, 1; in *xanthopa*, in which the fourth leg is also iridescent, the brilliance is equal to that of the third. A slight flattening of the iridescent surfaces is apparent in



TEXT-FIG. 4. Superimpositions of carapace profiles in *C. chalcea*. Solid line, 1st instar; dashed line, 2nd instar; dash-dot line, adult ♀; dotted line, adult ♂.

l three species, though to different extents, the greatest flattening being evident on the species and segments showing the highest iridescence. On the patella this flattening is always on the upper prolatelar distal surfaces; on the tibia and metatarsus it occurs in the upper half. On the most highly iridescent surfaces hairs are usually scant or absent. In live specimens iridescence is present on the femora and on all retrolatelar surfaces, although in these areas white scales and hairs are often well developed. In preserved specimens, however, a false, slight iridescence is sometimes apparent on anterior tip of femur and on posterior surfaces, while the true areas of iridescent planes are of much reduced brilliance.

Special Integumentary Structures.

Fringes: In adult males only. At least first three legs conspicuously fringed; *xanthopa* has the fourth legs also strongly fringed. Except in the latter species, in which the fourth fringe is best developed, the fringes occur in the following order of strength on the different legs, from greatest to least: 3-2-1-4. Dorsal and ventral fringes occur on the femur (rudimentary), patella, tibia and metatarsus. Except in the fourth leg fringe of *xanthopa*, in which the dorsal fringe is yellow and longer than the ventral fringe, all fringes are black, and the dorsal fringe is shorter than the ventral. The ventral fringes of femur and patella tend to be each in two distinct rows, prolatelar and retrolatelar; the remainder, however, are either median, or tend to cover evenly the entire ventral surface. A slight concentration of hairs occurring in preadults of both sexes and in adult females, on lower margins of leg segments, seems to be an adumbration of fringes.

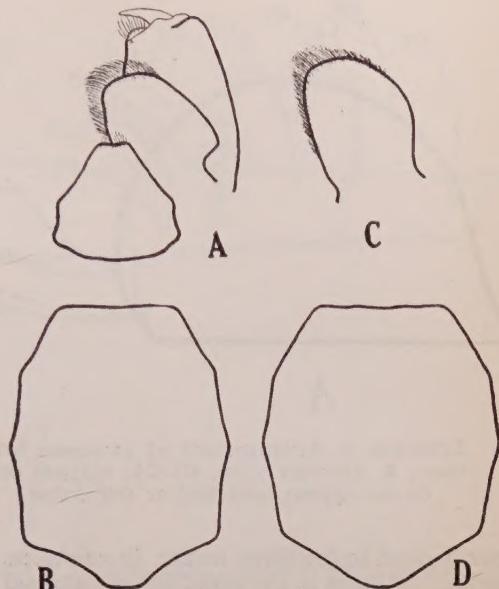
Spines: As will be seen from Table II, the following spines are constant in both sexes of all three species:

All legs: femur, dorsal 0-1-1-1; prolatelar, upper distal 1; patella, prolatelar 1; tibia, ventral distal 2; metatarsus, prolatelar and retrolatelar, proximal or near-proximal 1, upper distal 1; ventral proximal at least 1p, almost always 1r in addition; ventral distal 2.

First and second legs; tibia, prolatelar proximal or near proximal 1, distal 1.

Third and fourth legs: patella, retrolatelar 1; metatarsus, prolatelar and retrolatelar, lower distal 1.

It will be seen also from the Table that some spines, notably in the third and fourth legs, are constant except for rare females, these specimens sometimes having only a single side in one example of one species efficient. Included in this group are the tibial dorsals and the tibial median and distal proximal retrolatelars. In spite of their rarity, these variables, like the more common ones, apparently indicate a lack of genetic stability in the spine in question, which always is



TEXT-FIG. 5. A, C. *chalcea*, adult ♂; labium, maxilla and chelicera, ventral view; B, same, sternum drawn to same scale; C, C. *chalcea*, adult ♀; maxilla; D, C. *xanthopa*, adult ♂; sternum, at greater magnification, for comparison with *chalcea*.

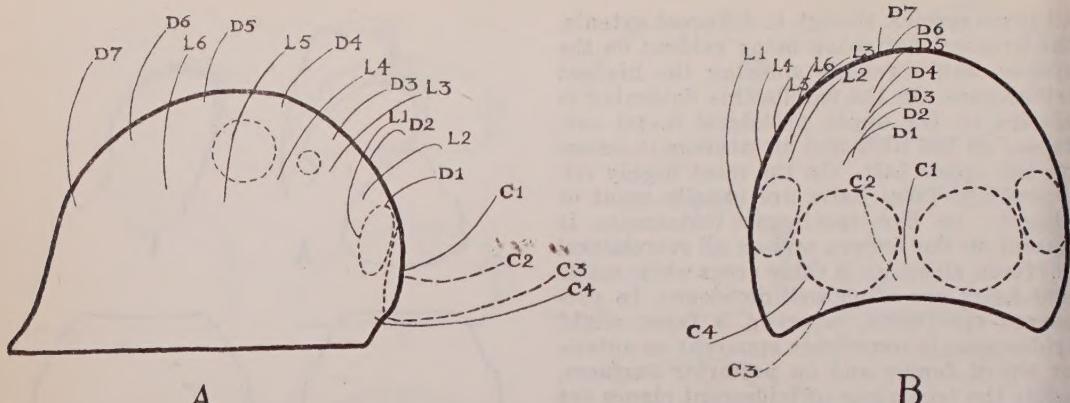
among those appearing late in ontogeny; the constant spines, on the other hand, invariably appear in early instars (see p. 18 and Text-fig. 2, FF, GG).

Constant differences are lacking between adults of both sexes of *chalcea* and *fulgipedia*; *xanthopa* invariably has a few spines fewer than the others.

There are no constant sexual differences within any of the three species, although in each females tend to have fewer spines than males, and their variability is greater.

In regard to exact position of insertion, there is considerable irregularity and variation, especially on the tibia. The dorsal spines on both tibia and metatarsus, and the unpaired tibial ventral proximal, may be inserted either before or behind the midline, although they usually occur behind it. Relative lengths are shown in Text-fig. 7.

Development of Spines. The course of development of the leg spines is similar in all three species, the same spines appearing earliest. On p. 18 and in Text-figs. 2 (FF, GG) and 7, is given a survey of the spine development in *chalcea*. Specific differences, aside from the differences in the adults noted in Table II, are confined to earlier or later appearances of some of the spines occurring first in the third, fourth and fifth instars. Compared with *chalcea*, the spines of *fulgipedia* tend to occur one or two stages earlier, and in *xanthopa* one stage later. The second instar is identical in *fulgipedia* and *chalcea*, while *xanthopa* differs from both only in having neither tibial spines nor first and second metatarsal ventral distals, which all ap-



TEXT-FIG. 6. Arrangement of carapace bristles in 1st instar of *Corythalia*. A, lateral view; B, anterior view. C1-C4: clypeal series (C2 and C3, indicated by broken lines, do not appear until 2nd or 3rd instar). D1-D7: dorsal series. L1-L6: lateral series.

pear instead in the third instar. In *xanthopa* the lag continues in the tibial and metatarsal ventral spines even into the sixth instar. It is this species which tends also to have fewer spines in the adult.

In all species, no spines appear before the second instar, although the femoral dorsals are represented by long hairs in the first. Often, later appearing spines appear to be represented by hairs in a preceding instar, but are never counted as such when in this rudimentary form; these hairs have no trace of the dark chitinous bases which characterize true spines and which, combined with great stiffness, usually obviate indecision as to whether a structure should be counted as a spine. No spines are ever found in any stage of the young which do not appear in at least one sex of the adult, this sex practically always being the male.

By the fifth instar, at least in *chalcea* and *fulgipedia*, all the constant spines found in both adult sexes may be present. No spine developed in or before this instar in any species is inconstant.

In general, the spines in a given series develop from the distal to the proximal end of a segment. (Exceptions are the highly variable first and second tibial retrolaterals). The fourth and third legs not only have more spines than the other two, but tend to develop their late-appearing variables slightly earlier. Among individuals, the retrolateral side of a third or fourth tibia often develops a late-appearing spine before the corresponding prolateral; however, the general tendency is for development to be from prolateral to retrolateral surfaces.

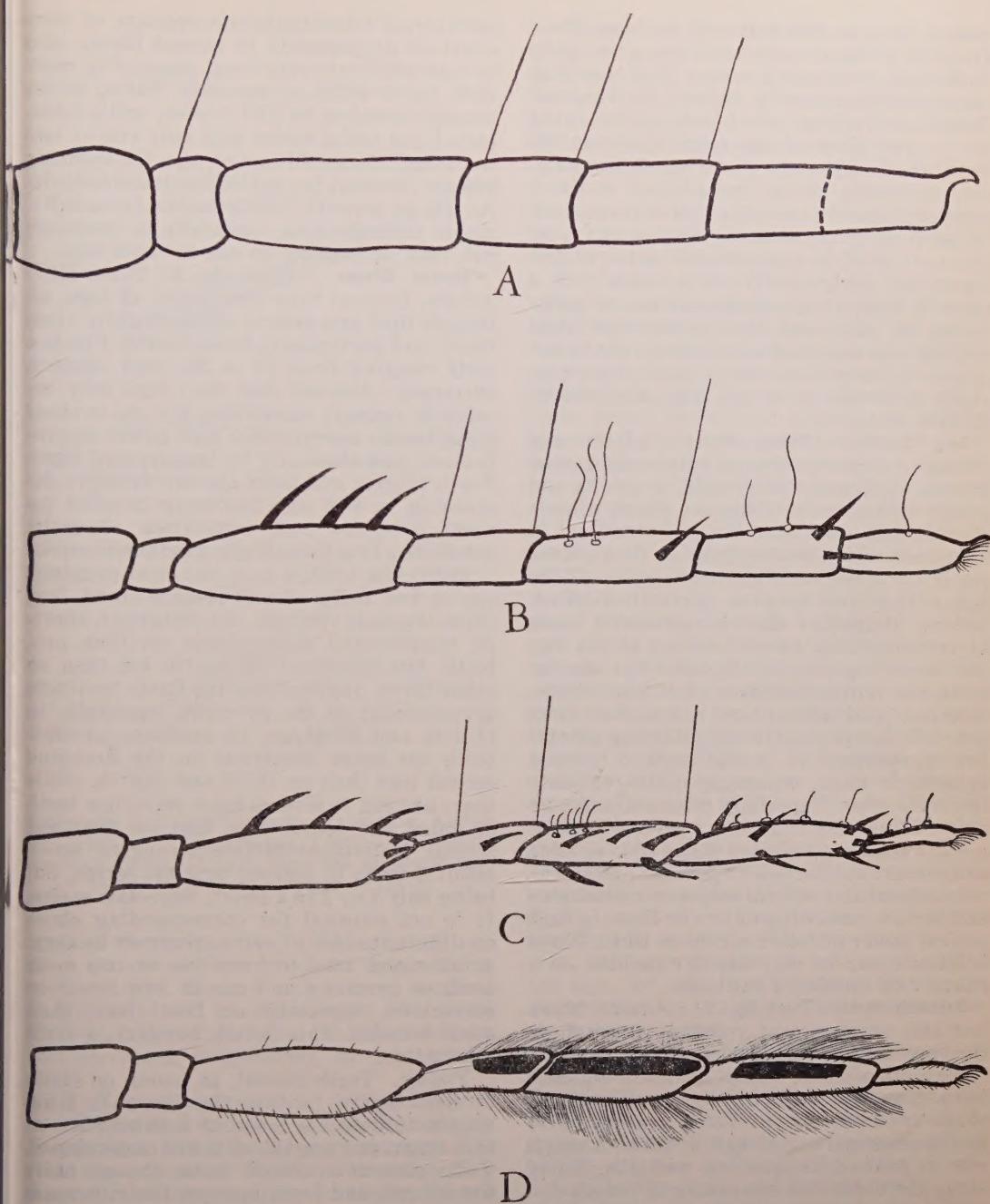
In general, the latest appearing spines, which are also the most variable, are the lower distal lateral femorals and the proximal spines of tibiae and metatarsi.

Bristles (Text-figs. 6, 7): The long stout bristles present on the clypeus and other parts of the carapace are probably homologous with those of the legs, and will be treated, for convenience, along with them.

These bristles, as a group, are of general occurrence in similar though not identical positions in a great many (if not all), salticids, in both sexes, and occur in early instars. I have been unable to detect specific differences in the three species of *Corythalia* under discussion, except that dorsal carapace bristles are more numerous in *fulgipedia* than in the other two species. Individual variation on the ocular quadrangle and thorax is considerable. The bristles are easily broken at the tip, or altogether lost, but their location can usually be detected from pits in the chitin.

Clypeace bristles: Adults. On the clypeus are three long median bristles, arranged in a triangular formation, of which the upper apical one is longest, and may measure up to two and one-half times the diameter of the AME; two pairs are inserted below the AME, one below their middle and the other external to these (Text-fig. 6B). Bristles in moderate numbers occur above all anterior eyes and between and below the dorsal eyes; there are a few on the ocular quadrangle itself and behind the PLE on the anterodorsal part of the thorax.

Young. Excluding those on clypeus, 13 pairs of carapace bristles are present in first instar and are traceable in some individuals of each stadium including adult. The frequent absence of particular bristles probably always is the result of accident. Later appearing bristles cannot be traced so successfully and are probably variable, as is the case with late-appearing spines; they will be disregarded here. Text-figure 6 shows the positions of the primary bristles. They divide themselves naturally into a dorsal series of seven pairs close to the midline, and a lateral series of six pairs arising near eyes. Three clypeus bristles are always present in first instar, the unpaired median (C1) and the outermost pair (C4); in second instar at least the C3 pair appears, and sometimes the median pair (C2) in addition; the full series of seven is always complete by third



TEXT-FIG. 7. Third leg in *C. chalcea*, showing segment proportions, development of primary bristles, spines, trichobothria and fringes. **A**, 1st instar; **B**, 2nd instar; **C**, adult ♂; **D**, same, to show fringes and iridescent areas (in black). Bristles represented by long, straight lines, spines by black triangles, trichobothria by curving lines with circular bases. Structures all drawn relative to total length of leg. Secondary bristles, short pale bristles and general hair covering omitted.

instar. In general the carapace bristles do not change much in relative lengths during development; an exception is the C1 median bristle, which is much shorter than C4 in first instar, but thereafter becomes far longer than all others in the series. Short bristles, very rudimentary and pale, appear on superior edges of chelicerae in fourth instar, 5 to

7 are countable in fifth, and more, now stiff and black, are present in adults.

Leg Bristles (Long): Adults and Young (Text-fig. 7). A few of the fairly numerous leg bristles stand out in all instars, beginning with first, and are traceable right through to adults of both sexes. These are located at proximal and distal ends of patella and distal

end of tibia on the palp and all legs. Their frequent absence is obviously due principally to damage; it seems, however, that they may sometimes be naturally lacking, in irregular fashion in various individuals, and varying on the two sides of the same specimen. Of the three bristles, the distal patellar is longest, measuring two or three times width of segment, and the proximal patellar shortest. In addition to these three longest and most constant bristles, a proximal tibial is of frequent and early occurrence on palp, and a more or less paired couple near end of metatarsus on palps and legs; additional tibial bristles also are often conspicuous, but do not appear so early in ontogeny, and are not constant. A trochanter bristle is usually present in first instar only.

Leg Bristles (Short, Pale): Adults and Young. A different type of bristle altogether occurs, apparently constantly, in adults and young on legs only. They are short, always shorter than trichobothria, and stand out in a fashion which makes them at first glance easily confused with short examples of the latter. They are, however, perfectly distinct, lacking altogether the characteristic bases of trichobothria, never bending at the tip, and occurring not only dorsally but also on sides and ventral surfaces of at least tibiae, metatarsi and tarsi. I have not studied these in detail, except to settle the following points: first appearance in second instar; location apparently fixed, occurring quite regularly in single rows. Especially constant and conspicuous are the following: several median dorsals appearing toward distal ends of tibia and tarsus; at least one on patella; prolateral, retro-lateral and ventral series on metatarsus and tarsus, consisting of two or three in each series; fewer of latter series on tibia. These bristles occur in very similar fashion on a number of unrelated salticids.

Trichobothria (Text-fig. 7): Adults. Number and arrangement constant throughout the species under discussion, and apparently typical of a great many salticids which I have examined superficially. In *Corythalia* there are two rows of three (rarely four) on the proximal dorsal half of tibia; a single row of four on metatarsus, well distributed along the crest and increasing in length distally; and a single row of three (rarely four) on proximal half of tarsus, also increasing in length distally. On some legs the pro- or retro-dorsal row on tibia is crowded toward proximal end, but I have not been able to find any specific sexual or special leg distinctions in this arrangement. Naturally, some of each series are frequently missing, but apparently practically always because of injury.

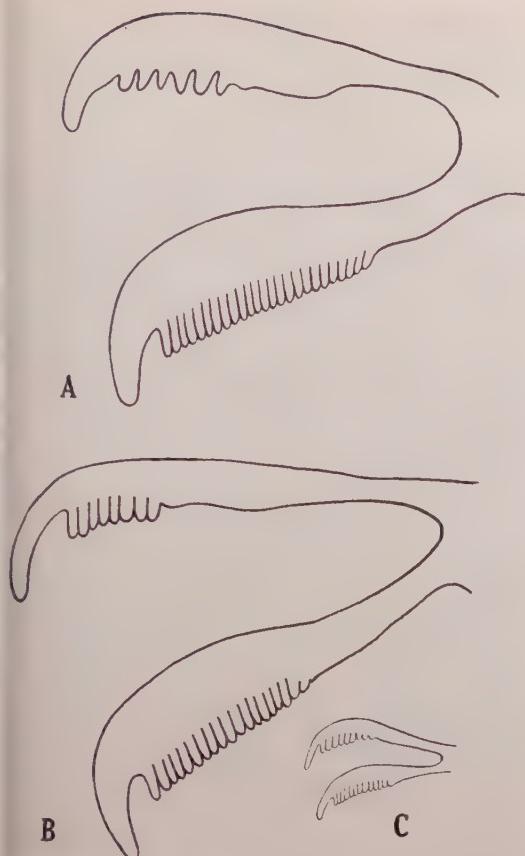
Young. Use of the highest power magnification fails to disclose any trichobothria in first instar. In second stadium, one to three in each series usually present, not in any standard order of precedence, even on corresponding legs of same specimen. The distal

metatarsal trichobothrium appears of very constant development in second instar, and is then relatively very long, measuring more than twice width of segment. Tarsal series usually complete by fifth instar, while metatarsal and tibial series lack only one or two trichobothria. In this stage, also, the absences are not constant for particular trichobothria. As late as seventh female instar (preadult), single trichobothria, especially on metatarsus, may be missing on one or more legs.

Tarsal Claws (Text-fig. 8; Table III): **Adults.** General type similar on all legs, although first and second differ slightly from third, and particularly from fourth. Proclaw teeth ranging from 13 to 26; very slender, extremely close-set and fine; tips only resolvable (except, sometimes, for one to three distal teeth) except under high power magnification, and then only by transmitted light. Teeth longest and most slender distally; decreasing in size and becoming broader toward proximal end, sometimes abruptly, sometimes in a beautifully graduated series.

Retroclaw teeth 4 to 9, the most proximal one or two being almost always broad, low, often truncate vestiges. All retroteeth shorter, broader and more widely set than pro-teeth, but closer set on fourth leg than on other three, approaching the finely pectinate arrangement of the proclaws, especially in *chalcea* and *xanthopa*. In numbers, proclaw teeth are more numerous on the first and second legs than on third and fourth, while there are one to several more retroclaw teeth on third and fourth legs than on first and second. Individual variation ranging up to about 5 teeth in longest proclaw series, but being only 1 or 2 in a short, retroclaw series. It is not unusual for corresponding claws on different sides of same specimen to vary. Adult males tend to have one or two more teeth on proclaws and one or two fewer on retroclaws, especially on front legs, than adult females. This is not, however, a rigid distinction.

Young. Teeth absent, as usual, on claws of first instar (within the cocoon). I am unable to detect a trace of a third claw at this stage, and ungual tufts are undeveloped. Tufts present in second instar though hairs are sparse, and from here on their increase is gradual. In second instar claw teeth also appear, and are of general adult form, being dissimilar, with proclaw teeth finer and more numerous than those of retroclaw, although they are not quite so closely set for their size as in adult. Also, the two claws of each foot are much more nearly alike than in adult, the number of teeth being intermediate to the final form; there are many fewer proteeth and usually one or more extra retro-teeth. (Sometimes, however, the number of retroteeth on posterior legs remains constant). This means that during development proteeth increase while retroteeth decrease. Another interesting point is that in the second instar the retroteeth of all four legs



TEXT-FIG. 8. Tarsal claws in *C. chalcea*. A, first leg, adult ♂; B, fourth leg, adult ♀; C, fourth leg, 2nd instar. In each case, the proseries contains the greater number of teeth.

instead of only the fourth leg, are finer and more closely set than in adults, approaching proteeth type. There is only a small increase in proteeth and no decrease in retroteeth through fifth instar. After that the increases and decreases, respectively, proceed gradually.

In all cases, increase or decrease occurs in the proximal end of a series, the anlagen or vestiges being broad and stumpy. The claw tips are more slender and entire claw more curved in young than in adults, though in *xanthopa* the juvenile shape is maintained and the teeth remain relatively similar, slender and close-set throughout, while the proseries of first and second legs do not attain the high numbers of the other two series.

Unspecialized Hairs; Scales: Hairs, apparently unspecialized, are present on all parts of the body in moderate numbers, especially on legs and abdomen. A few leg and abdomen hairs are present even in the first instar, and as in all integumentary structures, are relatively longer than in later stadia. *C. fulgipedia* is the hairiest of the three species. Scales and scale-hairs, because of their special connection with color pattern, are discussed under the heading of Color.

Palp: Adult Male (Text-fig. 9). Compared with its specific importance in other groups, the *Corythalia* palp is a relatively poor taxonomic character. It tends to great similarity among the three species under consideration, which have the following characteristics: tibia about two-thirds as long as patella, viewed dorsally; tarsus about one-third longer than patella; retrolateral tibial apophysis long or of moderate length, slender or stout, pointed or truncate, serrated or plain. A midventral tibial tubercle. Tarsal bulb overlapping tibia moderately at base; one median loop directed internally and two directed externally are distinguishable, the more proximal external loop being usually only partly visible; the exact proportions and amount of distinctness of the loops are decidedly variable in individuals of the same species. Embolus making about one full turn of spiral, this portion occupying distal one-quarter to two-fifths of bulb; distal part of embolus short or moderate, tip forked or simple. The palp of *fulgipedia* is decidedly more robust (as is the entire spider) than those of the other two species.

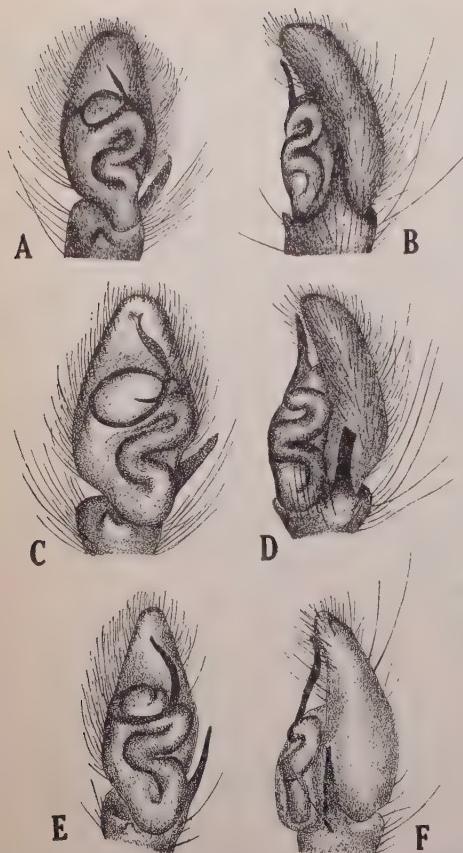
Young. The male palp is indistinguishable externally from that of the female until the sixth (preadult) instar. In the early stadia the tibia is equal to or longer than the patella, just as in females. In both sexes, unlike the legs, the palp is relatively longer in the first stages; as in the legs, the segments are more nearly equal.

Epigynum (Text-fig. 10). Of similar structure in all three species; specific differences lie chiefly in the size of the organ, since the latter is not proportional to the size of the species, and in the relative size and position of the anterior and posterior pairs of subdermal bodies, light and dark brown, respectively. Dissection shows the anterior bodies to consist of a pair of looped ducts, with the openings external and in advance of the genital slit, near the midline; presumably the spermatozoa are inserted here. A bulge

TABLE III.
Tarsal Claws in *Corythalia**

	First Leg			Fourth Leg		
	2nd Instar	Adult ♀	Adult ♂	2nd Instar	Adult ♀	Adult ♂
<i>chalcea</i>	p. 13; r. 10	p. 21; r. 7	p. 26; r. 6	p. 13; r. 9	p. 18; r. 8	p. 19; r. 7
<i>fulgipedia</i>	p. 14; r. 8	p. 24; r. 5	p. 24; r. 6	p. 10; r. 9	p. 18; r. 7	p. 18; r. 7
<i>xanthopa</i>	p. 11; r. 7	p. 13; r. 4	p. 17; r. 4	p. 8; r. 6	p. 13; r. 6	p. 15; r. 6

* From characteristic specimens.



TEXT-FIG. 9. Left palp of adult ♂ in *Corythalia*, ventral and ectal views. A, B, C. *chalcea*; C, D, C. *fulgipedia*; E, F, C. *xanthopa*.

in each duct appears to be a small gland opening into it. The ducts curve to the mid-line, whence they proceed, parallel and contiguous, into the pair of posterior spermathecae, which form the second pair of dark bodies visible externally. The passages to the vagina are a pair of small tubules opening from the anterodorsal section of the spermathecae, near the mid-line. A pair of more or less distinct, smooth, bean-shaped, translucent areas cover most of this tubule-spermatheca system.

In actual size, the epigynum of *chalcea*, one of the larger forms, is slightly smaller than that of *xanthopa*, the smallest species.

Young. No trace of the epigynum is visible, at least externally, before the sixth instar (pre-preadult). Then the spermathecae are barely discernible as a pair of minute dark spots just in front of the genital furrow. By the seventh stadium, the spots are clearly distinct.

Abdomen: Adults and Young. Ovoid, widest near middle but of exceedingly variable proportions in individuals of both sexes. Anal tubercle a short flattened cone. Spinnerets all of moderate width; anterior pair stoutest, middle pair longest, posterior pair shortest and slimmest. Colulus indistinguish-

able, apparently represented by a few stiff hairs; tracheal spiracle opening near base of spinnerets. Segmentation discernible posteriorly during first instar.

SIZE AND GROWTH.

The total length range in adults is from 3.46 to 7.2 mm., that of carapace length 2.05 to 3.83. Sexual dimorphism in size is slight, the carapace length of the largest males in each species exceeding that of the smallest females, while even the total length of some recently molted females (before the eggs have enlarged) may be less than that of males. *C. chalcea* and *fulgipedia* are of almost equal size, although *fulgipedia* is bulkier, being more robustly built, particularly in legs and palps, and is hairier. *C. xanthopa* is a smaller species.

All species have one more instar in the female than in the male; at least in *chalcea* and *fulgipedia* the male has seven instars, including the adult, the female eight. Individuals of both sexes of each of these were reared from the egg. In *xanthopa* the fourth instar, if it exists, is unknown, reared specimens having died in the third instar, a younger stadium than that of the youngest captured field specimens. The smaller size of *xanthopa* makes it possible that there are only 6 male and 7 female instars in this species, although the gap is considerable (Text-fig. 11). However, for convenience in comparison of text-figures and descriptions, this stadium is considered to exist.

Table IV gives average carapace lengths at various stadia. As usual (cf. Bonnet, 1930, p. 469) the length increases are slight in the early instars; during the first, total length actually decreases owing to the absorption of yolk. In both sexes of all species there was found to be great individual variation in the amount of carapace length increase in individuals between the last two instars. As a single example, one male *C. xanthopa* reached 90% of his final carapace length in the preadult instar, while another attained 82%. These variations must be kept in mind in a consideration of Text-fig. 11, p. 20.

TABLE IV.

Comparison of Average Carapace Length in *Corythalia* (mm.).

Instar	<i>chalcea</i>	<i>fulgipedia</i>	<i>xanthopa</i>
1st	.93	.91	.83
2nd	1.2	1.1	1.0
3rd	1.4	1.3	1.1
4th	1.6	1.6	—
5th	2.0	2.1	1.5
6th ♀	2.4	2.4	1.9
6th ♂	2.7	2.6	2.1
7th ♀	2.8	3.0	2.1
Adult ♂	3.1	3.2	2.4
Adult ♀	3.4	3.6	2.6

The durations of the instars proved variable, even when members of the same brood were reared under identical conditions. In the Rancho Grande laboratory, at a mean

temperature of about 70° F., individual instars ranged from about 12 days to more than 8 weeks. In general, the earlier instars lasted around two or three weeks, the later ones around four or more. The longest and the most variable were the preadult stadia. A group of *fulgipedea* carried by ship to New York in the egg stage had all the instar lengths greatly prolonged, although they were never exposed to cooler temperatures than those of the Rancho Grande laboratory, and the average and extreme temperatures of the Zoological Park laboratory were higher. The time required for reaching the adult stage is around five or six months, the males requiring several weeks less than the females. One female *fulgipedea*, reared from the egg, lived to an age of 11½ months, and a male to 11 months. No variations in numbers of instars were found in any species, save in one abnormal *C. chalcea* (p. 16).

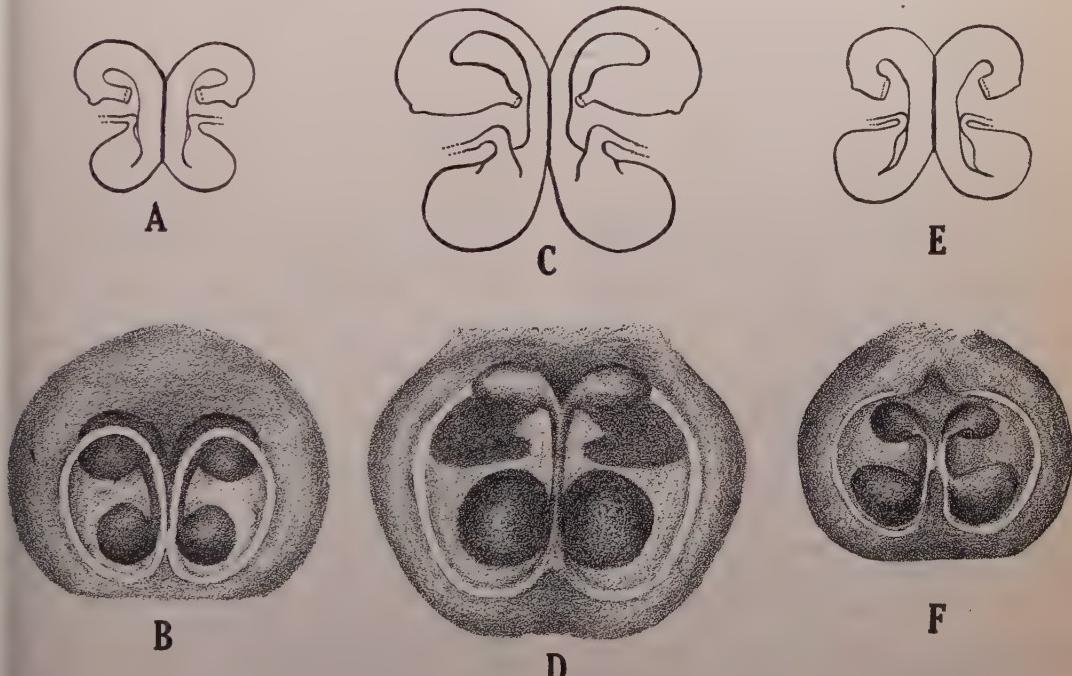
BEHAVIOR.

The general habits of all three species of *Corythalia* are exceedingly similar, both to each other and to the general pattern of salticid behavior. All are diurnal spiders which leap on their prey, eat it at once, pass the night in silk shelters, perform special courtship displays as a necessary preliminary to mating, copulate with the male in the dorsal position and guard the eggs in a cocoon spun between the folded edges of leaves.

The first instar is passed within the co-

oon; the spiderling neither eats nor spins, moves about with difficulty, and is helpless when removed from the nest. From the second instar onwards, however, the young engage in all salticid activities except those connected with breeding. From two days to a week or more is passed in the silk shelter before molting; during this time no food is taken; the spider emerges from one to three days or more after molting. Retirement lasts longest during the molt to the adult. In the laboratory the same shelter is used for successive molts and for passing the night, as long as it is not disturbed; the young spider simply enlarges it as needed, sometimes casting out the exuviae, sometimes incorporating them into the cocoon. Brooding females eat and move about very little. When disturbed they knit up a torn cocoon promptly; one female which escaped and was returned to her jar after three days, readopted the cocoon at once. Three clutches of eggs are usually laid, beginning about 8 or 9 weeks after the molt, the first being the largest and containing between 13 and 28 eggs. After mating, the female loses most or all of her attraction for males within less than 24 hours, and in any case will not accept another male. The latter apparently fill their palps in their shelters (I have never seen a sperm web in this group) and will mate with a series of females from two to three days after molting until at least six weeks after that time. After that their display energy diminishes rapidly.

None of the above activities differs re-



TEXT-FIG. 10. Epigyna in *Corythalia*, all drawn to same scale. Upper row, dorsal (internal) views of dissections; lower row, ventral (external) views. A, B, *C. chalcea*; C, S, *C. fulgipedea*; E, F, *C. xanthopa*. Note that dissected epigynum is smallest in *C. chalcea*, although that species is intermediate in average carapace size, and overlaps size range of *C. fulgipedea*.

markably in the three species considered here. The epigamic displays, however, show great specific distinctions. In all, threat and courtship displays are moderately or strongly differentiated; the fringed and iridescent legs play a conspicuous part at least in threat displays and usually in courtship display as well; in *xanthopa*, however, all fringe and iridescence display is excluded from courtship. True fighting is exceedingly rare in *Corythalia*, and probably never occurs under natural conditions. The subject of display will be discussed in detail, including correlated experimental data, in the sequel to the present paper.

I never saw a hint of cannibalism in *Corythalia*, either between mother and young, or between young of similar size; even several pairs of adults of the same species, quite often of various sizes, sometimes lived peacefully together for weeks, as long as they were well fed and uncrowded.

HABITAT.

The three species of *Corythalia* at Rancho Grande extend from the deciduous seasonal into the cloud forests, from 700 to at least 1,300 meters; their humidity requirements range from moderate to high, the temperatures from upper tropical to lower subtropical. They are never found in either open country or dense forest, and all are predominantly terrestrial, although *C. chalcea* occasionally lives in epiphytic bromeliads. None was ever taken by shaking bushes or saplings.

KEYS TO THE RANCHO GRANDE SPECIES OF *CORYTHALIA* (ADULTS).

The following keys apply equally well to fresh and preserved specimens:

MALES.

- A. 4th leg with well-developed fringes; 1st leg with 1 femoral prolateral spine and with clearly fewer than 20 teeth on tarsal proclaw; tibial apophysis of palp pointed, non-serrate; plentiful long yellow hairs on clypeus and palp; no submarginal carapace band. *C. xanthopa*, p. 29.
- AA. 4th leg with fringes rudimentary or absent; 1st leg with 2 femoral prolateral spines and with clearly more than 20 teeth on tarsal proclaw; tibial apophysis of palp serrated distally; clypeus naked or with a few light scales.
- B. Submarginal carapace band rudimentary or absent; tibial apophysis of palp and tip of embolus pointed. *C. chalcea*, p. 14.
- BB. Submarginal carapace band strongly developed, persistent in alcohol; tibial apophysis of palp truncate; tip of embolus forked. *C. fulgipedia*, p. 22.

FEMALES.

- A. Abdomen with 2 broad, longitudinal dorsal pale stripes; no submarginal carapace band; 1st leg with 1 femoral prolateral spine and with clearly fewer than 20 teeth on tarsal proclaw. *C. xanthopa*, p. 29.
- AA. Abdomen without longitudinal stripes, but with a broad, pale band across posterior third; 1st leg with 2 femoral prolateral spines and with clearly more than 20 teeth on tarsal proclaw.
- B. Submarginal carapace band rudimentary or absent; pale clypeal hairs and scales scanty; breadth of epigynal plate less than diameter of one AME. *C. chalcea*, p. 14.
- BB. Submarginal carapace band strongly developed; pale clypeal hairs and scales abundant; breadth of epigynal plate greater than combined diameters of one AME and one ALE. *C. fulgipedia*, p. 22.

DESCRIPTIONS OF THE SPECIES.

Corythalia chalcea sp. nov.

DIAGNOSIS.

Adults of both sexes without pale markings on clypeus, chelicerae and palps, or with only a few sparse white scales; submarginal carapace band of white scales present, but sparse, throughout instars. Adult male with abdomen solidly covered with bronze scales above (brownish in alcohol), through which pale basal and median bands and two terminal spots are dimly visible. Adult female abdomen in life with successive bands of silvery-white, bronze, black, golden-yellow and black, the latter marked with a median bronze stripe and a terminal pair of golden-yellow spots; in alcohol these markings are obscured and faded, but at least the second light band is persistent; young with two abdominal bands brilliant silvery white, second through fifth instar. Adults of both sexes with two femoral prolateral spines on first leg, and clearly more than 20 teeth on its tarsal proclaw. Adult male with fringes well developed on first three legs, absent or with mere rudiments on fourth. Tibial apophysis of palp serrated distally, its tip and that of embolus both pointed; breadth of epigynal plate less than diameter of one AME. Second and third legs, but not fourth, elevated during both courtship and aggressive display, although the two are distinct; no rocking in either. Size moderate, total length of adult males around 5.5 mm., of females around 6.5 mm. Terrestrial and arboreal (especially in epiphytes) to a height of at least 8 meters; montane cloud forest only, 1,100 to at least 1,300 meters.

EXTERNAL CHARACTERISTICS IN ADULTS AND YOUNG.

COLOR IN LIFE.

(Text-figs. 2, A-X, AA-EE; 12; 15 A).

ADULT MALE: *Cephalothorax.* Integument of carapace black, ocular quadrangle with a few long black hairs, almost naked or more or less completely covered with golden bronze scales, which may extend in a triangle over the flattened, postocular region bounded posteriorly by the steep thoracic slope, as well as on the side just below level of dorsal eyes, on the margins of which they are strongly concentrated. On each side a scanty submarginal cephalothoracic border of white starts at level of posterior eyes and extends almost to pedicel.

Anterior eyes with deep green reflections, all four surrounded by hairs varying from cadmium yellow to ochraceous orange, except outer upper margin of antero-lateral eyes. Clypeus with a sparse double row of short white scales and hairs, the marginal longer than the submarginal, the hairs of both rows all directed toward the center. Chelicerae with a moderate sprinkling of white hairs, longest on the internal margins; palps completely black except for the usual terminal patch of grayish short hairs. Sternum black.

All legs black except for very pale straw-colored third and fourth tarsi. All fringes jet black (except white scale-hairs on femora described below). White scales on legs as follows: on at least third and fourth coxae, with usually a few on second, and on all three trochanters; to various extents on dorsal and postero-dorsal surfaces of all femora, but on anterior side only on third and fourth, where they form a conspicuous antero-dorsal distal band of scales and a short antero-ventral distal fringe of scale-hairs, longest distally; this fringe is better developed on third than on fourth leg. A few scales, yellow rather than white, on dorso-posterior surfaces of all patellae, and tibiae, and, on the fourth leg, of metatarsus and of anterior sides of these segments as well.

Iridescence present on first three legs as follows: these areas are covered with specially flattened, smooth and completely or practically hairless facets. Patellae: first, second and third; upper distal half of anterior face (demarcated sharply by the diagonal) and bent along it. Tibiae: first, second and third; entire anterior side, but the upper (antero-dorsal) aspect of this being naked and slightly flattened, it is the most effective. Metatarsi: first, second and third; antero-upper sides, especially of third, form narrow, shining strips. No trace of iridescence on fourth leg, or on other surfaces of the first three, which have in the bare spots only the ordinary gloss of unspecialized chitin. Without any question, the most brilliant areas are all three patellae, all three tibiae and the third metatarsus.

Abdomen. Integument black, densely cov-

ered except at extreme base with golden bronze scales, through which project relatively few long hairs. Through the scales is more or less dimly visible the typical *Corythalia* band pattern: a sub-basal band of white scales, a post-median band of gold and two terminal gold spots, well separated. Underside of abdomen black, naked save for a variable amount of black pubescence.

Rubbed, old specimens may have the cephalothorax practically or altogether destitute of bronze and white scales, while the bands and spots of the abdomen show plainly. The first scales to be lost are those on the ocular quadrangle and submarginal border of the carapace. Enough of the bronze abdominal coating always remains, however, to make field identification easy. Alcoholic specimens resemble rubbed examples.

ADULT FEMALE: *Cephalothorax.* Dorsal and anterior aspect of carapace as in male, except that there is a more decided concentration of the scales into a spot behind each small eye, and sometimes behind each posterior eye as well. Also, the submarginal carapace band is scantier, and the antero-lateral eye may be rimmed completely instead of only partially with orange, the clypeus bands of white and the white hairs on chelicerae are somewhat better developed, there are a few white hairs below inner margin of anterior lateral eyes, and in addition the palps have some white decoration, in a band of close-set scales across tip of femur and with a few scattered scales and hairs on patellae and even fewer on tibia. Sternum black.

All legs black except for very slightly paler coxae and trochanters and first and second tarsi; as in the male, the third and fourth tarsi are very pale. There are white and pale bronze scales to a very variable extent in the following localities: on all coxae, trochanters, femora (especially in a band across tip of latter), patellae and tibiae. On the metatarsi they may be present or absent, sparsely, but are usually found at least on those of the last two legs. Unlike the case of the male, all of these scale groups are developed on the anterior as well as on the dorso-posterior surfaces.

Abdomen. Integument black, with a broad, sub-basal band—the width being variable—of solid bronze scales which leave uncovered, at least laterally, along its anterior edge a trace of a narrow silver-white band. Behind this anterior bronze is a narrow band of black, then a band of gold scales closest to a metallic buff yellow (Ridgway), slightly convex anteriorly, and broadly and shallowly scalloped posteriorly. This is followed by a median bronze stripe down the middle of the succeeding black band, which continues to the dark spinnerets. Just in front of the latter is a pair of oval gold spots of the same shade as the second abdominal band. These various bands extend midway down the sides, and the first, bronze band curves back laterally to join the second, gold band. Below this

point the sides are black covered with yellowish-white scales; venter black with a moderately dense coating of light yellow scales.

Rubbed, old specimens, as in the male, may have the carapace and legs practically destitute of white and bronze scales, the first to disappear being from the apex of the ocular quadrangle. Similarly, the anterior bronze band of the abdomen deteriorates to show clearly the entire width of the anterior narrow band of silvery white, while the posterior gold band and spots become so rubbed that they appear almost white, the integument underlying this particular band and the spots being pale.

Variation. As has been suggested, the normal, individual variation is considerable in the amount of white sculation on carapace and legs, in the width of the bronze abdominal band, and in the shade of gold of the second band and terminal spots, these differences being visible even in newly molted, unrubbed specimens. The following two examples, however, are distinct enough to warrant separate remarks. The first, No. 5, was reared from the third instar, all the subsequent instars being of normal pattern. In spite of her peculiar appearance, six different males displayed promptly to her and attempted to mate without hesitation, before she was permitted to mate with a seventh, and then killed. She differed from the typical most obviously in: (1) anterior bronze abdominal band extended practically to the second (gold) band, and was actually joined to it by a pair of conspicuous, gold, bronze-outlined chevrons on either side of midline. Hence between the two metallic bands were only three small patches of black, of which the median was triangular. (2) The median stripe behind the second band was pale gold rather than bronze, only slightly deeper in tone than the second band and spots, and was formed of small confluent chevrons. The remaining differences were only relative, and included within the bounds of normal variation, a number of other females having them to the same extent; the second band and posterior spots were very pale gilt and the scales of the carapace border, clypeus and legs developed to maximum extent for this species.

The second abnormal female, No. 16, was reared from the egg; her brothers and sisters were completely typical of the species. This example was peculiar not only in coloration, but also in incomplete spinulation and especially in the fact that she underwent 9 molts instead of 8 and even then was not adult. From the second instar her peculiarities were evident; she had the entire posterior half of abdomen brilliant silvery white, instead of broken into a band and terminal spots, and her legs never developed more than the faintest bandings of pigment.

YOUNG. FIRST INSTAR. Typical of *Corythalia*: true pigment lacking, but with the usual two dark abdominal bands clearly visible in latter part of stadium.

SECOND INSTAR. Carapace above black lacking scales entirely. AME with a few yellowish-orange marginal scales. Clypeus mouthparts and sternum dark gray to black. Palps, legs and spinnerets translucent buff with slight or no darkening at the joints. Abdomen: the two bands and small pair of terminal spots are shining silvery white, the anterior band usually wider than the posterior. Venter translucent and colorless.

THIRD INSTAR. All markings shining silver white. Carapace with a variable number of scales on ocular quadrangle, ranging from a simple spot behind each PME to a pair of bars extending obliquely forward between PME and AME. A strong crossbar, of variable width, is always present across anterior part of thorax behind PLE; in some specimens this has a very faint gilt tinge, which may prove to be a sexual difference. AME and ALE both rimmed with scales ranging from yellowish through orange to deep rust-color, though the ALE rimming is still incomplete on upper outer margins; frontals otherwise unchanged from second instar. Legs strongly barred with dark pigment, usually deposited at all joints except between coxae, trochanters and femora; strength of banding highly variable, even in individuals of the same brood on corresponding days after molting. Abdomen above as in second instar. Venter grayish-black to black.

FOURTH INSTAR. Differs from third as follows: a slight yellowish or bronze tinge on some ocular quadrangle scales; clypeus sometimes with a scanty submarginal border of white scale-hairs; femur of palp sometimes darkened basally; its distal end and patella rarely with a few white scales; leg integument darker, usually only coxae, trochanters and tarsi remaining pale; second abdominal band sometimes followed by one or two white scales in the midline.

FIFTH INSTAR. Ocular quadrangle with a frosting of bronze or bronzy-gold scales moderately or well developed, although the primary spots and postocular bar are still sharply defined even when reduced in size. ALE sometimes completely rimmed with rust scales. Clypeus with submarginal band of scale hairs well developed, sometimes with a second line of scales immediately above it and sometimes with a few more scales below each AME. One example had a very few submarginal thoracic scales, but they usually do not appear until the sixth instar. Palp integument dark or pale; all legs usually dark except tarsi, and all, or only third and fourth coxae and trochanters; leg tibiae and metatarsi sometimes slightly paler; a few white scales on palps, chelicerae and legs. First abdominal band with a trace of bronze across its posterior border and in midline behind second band; second band, at least in male, may have a faint tinge of silver gilt. Venter dark brown or black, with or without one or several darker median stripes; a scattering of white scales present.

SIXTH INSTAR. Ocular quadrangle with a general frosting of bronze or gold scales well developed, usually extending behind ocular quadrangle on anterior thorax to a greater or less extent, and even slightly below dorsal eyes on sides of carapace; the primary scales—white spots behind PME and the bar behind PLE—are still traceable, however, and sometimes persist strongly under the colored scales. Marginal scales of anterior eyes varying from rust to bright orange. Clypeus with at least a submarginal band of white scale-hairs and usually with a second band of scales just above it, as well as a few below each ALE. Thoracic submarginal scales present or absent, sometimes absent in individuals which had them in the preceding stadium. Integument of palp practically black, and of all legs except brown tarsi. White scale or scale-hairs on appendages variable in number, never profuse, usually present at least on patella of palp, and may be present on every leg segment except tarsi, regardless of sex; they tend to be best developed on anterior surfaces. Abdomen with the bronze posterior portion of first band and in midline behind second much better developed than in preceding stadium, but not so extensive or strongly colored as in adult female. There appears to be a definite sexual difference in the brightness of the gilt tinge to the second band: in females it is definitely paler than in males, where it should now be described as pale gold rather than silver gilt. Terminal abdominal spots now usually joining in a white bar. Venter black, usually with a uniform scattering of white scales.

SEVENTH INSTAR. (Female). Differs from adult female only in the usually slightly greater number of white scales on clypeus, palps, chelicerae and legs, in the lesser extent of the bronze portion of the anterior abdominal band, and in the color of the second band and terminal spots, which are still only silver gilt, not golden yellow. It is thus perfectly intermediate between the sixth stadium and the adult. The white scales are as usual highly variable.

SUMMARY OF COLOR DEVELOPMENT IN *C. chalcea*: Integument. Carapace, mouthparts and sternum black in second instar. Palps may begin to darken in fourth, usually not until fifth, pigment not complete until sixth. Legs scarcely banded in second, strongly in third, color complete except for tarsi in sixth. Abdomen black above (with usual two sub-scale bands and paired terminal spots) in second, venter black in third. *Light-colored scales and hairs:* carapace above lacking scales until third instar, when they appear as a pair of ocular quadrangle spots or oblique bars and a postocular bar of silver white, which form the primary carapace scalation; a general frosting of bronze secondary scales begins in fourth on and close behind ocular quadrangle, reaching maximum development in sixth and seventh instars. White submarginal scales on sides of

thorax may appear in fifth, usually not until sixth, and may thereafter persist or disappear. AME first rimmed with yellowish in second, ALE in third, although rimming of latter eyes is not complete until fifth. White scales usually first appear on clypeus, chelicerae and palps in fifth, rarely in fourth; leg scales never appear before fifth; in males these frontal and leg scales usually reach maximum development in sixth (preadult) instar, sometimes in fifth; in females maximum development usually occurs in seventh (preadult). Abdomen with two sharp bands and a pair of terminal spots formed of brilliant silvery white scales until fifth; in this stadium bronze becomes visible in posterior part of first band and in midline behind second; also it seems likely that the faint gilt tinge sometimes apparent on second band is confined to males; if so, it is the only sexual distinction so far found among the three species before the sixth instar; in the sixth, this color distinction is unquestionable, the second band being pale gold in males, scarcely silver gilt in females; the bronze is also better developed in males; the seventh stadium of the female has the bronze and gold about as well developed as in the sixth male, but less strong than in the adult female. The terminal spots tend to be joined by a less distinct silvery band in the fifth. White scales first appear on the venter in the fourth (rarely) or fifth.

STRUCTURE.

With the characteristics described on p. 3 ff.

In contrast to color development, the course of post-embryological development of structure shows no clear distinctions from the closely related *fulgipedia*, except in the tardiness of the appearance of some of the spines. The general account of postembryological development, under the various structures, is given on pp. 4 ff. The account below, therefore, concerns adults only, unless otherwise noted.

Ranges and averages of proportions of adults are given in Table V, and comparisons with the other species in Table I.

Carapace. Height slightly more than half of length; anterior part of thoracic profile descending moderately gently. Anterior width of ocular quadrangle clearly narrower than width of carapace. Width at level of second-to-third coxa scarcely more than that at bulge before PLE.

Eyes. All eyes larger than in the closely related *fulgipedia*, and about the same, relatively, as in *xanthopa*, except that ALE and PLE are smaller than in the latter. PME about midway between ALE and PLE.

Clypeus. Half or slightly less than half diameter of AME.

Chelicerae. Apparently no teeth on proximal margin.

Maxillae. Outer margin distinctly concave; tubercle well developed.

TABLE V.
Relative Proportions in *C. chalcea*.

	Males	Females		
	Range %	Average %	Range %	Average %
Carapace Length: Breadth	71-74	72.6	70-75	72.2
Carapace Length: Height	48-55	51.2	48-54	51.6
Carapace Length: Oc. Quad. Length	36-42	38.8	37-40	38.2
Carapace Length: Oc. Quad. Breadth	57-65	60.6	56-63	59.9
Carapace Length: AME Diameter	18-21	19.2	18-19	18.6
AME Diameter: ALE Diameter	61-64	63.0	57-65	61.4
AME Diameter: MLE Diameter	16-20	18.0	16-18	17.0
AME Diameter: PLE Diameter	56-62	58.4	54-57	55.6
AME Diameter: Clypeus	42-53	48.0	46-54	50.2
Carapace Length: 1st Tibia	35-40	37.2	29-34	30.8
Carapace Length: 2nd Tibia	35-39	36.0	29-31	29.6
Carapace Length: 3rd Tibia	44-48	45.6	35-40	37.6
Carapace Length: 4th Tibia	43-46	44.0	39-41	39.8
Carapace Length: 1st Metatarsus	30-33	31.8	28-28	28.0
Carapace Length: 2nd Metatarsus	29-33	31.0	26-30	27.4
Carapace Length: 3rd Metatarsus	48-54	51.2	40-44	42.0
Carapace Length: 4th Metatarsus	51-55	53.2	44-49	46.2
Carapace Length: Palp	70-81	74.4	80-84	81.2

Lip. No distinctive specific characteristics.

Sternum. Width three-fourths of length in male, slightly less in female; not quite as wide anteriorly as base of lip; lateral excavations well developed.

Bristles. No distinctive specific characteristics.

Legs. Third leg longer than fourth leg in all males, but in less than half of females; first leg longer than second in practically all males and in most females. In the formula, Table VI, the alternate order is expressed by the figures in parentheses in the upper row; figures of proportions are averages; for range of variation see Table V. Segments slender like *xanthopa* and unlike *fulgipedia*. Tibial index: first leg, males 25 to 27, females 27 to 28; fourth leg, males 19 to 21, females 18 only. Iridescence strong in adult male, but not as strong as in *fulgipedia*, nor are the segments as sharply modified. Fringes as long as in *fulgipedia*, but not so thick, present on first three legs although sparse on first; there is a rudimentary trace on fourth leg. See description of *fulgipedia*, p. 26, for details of occurrence of iridescence and of fringe arrangement, since in that species these adornments reach their highest development. Table VII shows change in segment proportions with growth.

TABLE VI.
C. chalcea: Leg Formula.

	3(4)	4(3)	1(2)	2(1)
Males	2.21	2.08	1.74	1.71
Females	1.96	1.97	1.57	1.55

Spines. There are no invariable spine differences separating *chalcea* from *fulgipedia*, nor the sexes from each other. Comparisons of the three species, with variables are given in Table II. The order of spine development in this species follows the general outline given on p. 7. The following paragraphs describe spine development by instars (see also Text-figs. 2 (FF, GG) and 7).

Second Instar. First leg: all three femora dorsals; tibial distal (usually); metatarsal prolateral distal; metatarsal ventrals, proximals and distals. Second leg: like first except metatarsal proximal proventral lacking. Third leg: like first except for addition of tibial retrolateral distal; metatarsal pro-lateral and retro-lateral distals complete. Metatarsal ventral distals rarely present. (Note: these ventral spines may appear on either third or fourth legs, on either side and in the pro- or retro-series at any time through fifth instar. When present in second instar they are small and weak, scarcely more than bristles). Fourth leg: like third except that tibial prolaterals and retro-laterals may be lacking.

Third Instar. As in second.

Fourth Instar. The following spines are usually present in fourth instar, in addition to those appearing in second: all legs: femoral distal upper prolateral; patellar prolateral. Second leg: metatarsal proventral proximal (or appears equally frequently in fifth instar). Third and fourth legs: patellar retro-lateral. Fourth leg: tibial median retro-lateral; metatarsal median retro-lateral. Any leg: tibial distal ventral. (The latter spines however, never appear in all legs in this stadium, and occur rather as a typical fifth instar development).

Fifth Instar. There now appear any of the previous series which did not appear in the fourth instar. In addition, on all legs: femoral distal upper and sometimes lower, retro-laterals; femoral distal lower prolaterals (occasionally; usually not until later, especially on third and fourth legs); tibial distal ventrals and middle prolaterals (latter sometimes absent on third and fourth legs). On first and second legs: metatarsal proximal prolaterals and distal retro-laterals. On third and fourth legs: tibial proximal ventral (rarely in fourth); metatarsal proximal proventrals (or in fourth or sixth); metatarsa-

C. chalcea: Change of Leg Proportions with Growth.

(Figures are percentages averaged from leg measurements of three typical individuals in each group).

	1st Leg	2nd Leg	3rd Leg	4th Leg	
% of entire leg to all legs.					Adult ♂
Coxa	23.5	22.5	22.3	22.4	23.5
Trochanter	14	12	12	10	14
Femur	8	5	5	7	7
Patella	24	27	27	26	28
Tibia	14	13	15	14	14
Metatarsus	16	15	16	18	16
Tarsus	24	13	10	10	24
					26
					13
					9
					14
					10
					10
					9
					25
					13
					8
					8
					26.6
					28.6
					27.4
					27.0
					28.0
					28.1
					26.6

proximal pro- and retrolaterals (third leg sometimes) and median pro- and retrolaterals (fourth leg). By the fifth instar all constant spines found in both adult sexes may be present, except for third and fourth metatarsal proximal retroventrals.

Sixth Instar, Male. In this stadium the following spines appear: any of the above mentioned spines not previously present plus the following: First and second legs: tibial median retroventral; sometimes tibial median proximal; usually tibial proximal retroventral; always metatarsal proximal retrolateral. Second leg only: tibial proximal prolateral; rarely, tibial distal retrolateral. Third and fourth legs: tibial prolateral proximal (sometimes absent in fourth leg); tibial retrolateral proximal (sometimes absent on third leg); tibial dorsal usually present; metatarsal dorsal present or absent on either or both legs; metatarsal proximal retroventral present on third, sometimes on fourth; fourth metatarsal proximal prolateral present or absent; fourth metatarsal proximal retrolateral present or absent. The only spines of adult always absent in this instar are the first tibial retrolateral(s), the second patellar retrolateral, and the second tibial proximal retrolateral; all these spines may be absent in the adult.

Sixth Instar, Female. The female has never added all of the above to her fifth instar spines; most are usually lacking, except the fourth metatarsal proximal retroventral, which is constant in the six specimens examined. Of the others, only the first and second tibial median retroventrals, the first and second metatarsal retrolaterals, the fourth tibial proximal retrolateral and fourth metatarsal proximal prolateral ever occur in this stadium.

Seventh Instar, Female. Like sixth in female, except that fourth metatarsal proximal prolateral is always present.

Trichobothria; *Long, Dark Bristles*; *Short, Pale Bristles*. (Text-figs. 6, 7). No distinctive specific characteristics.

Tarsal Claws. (Text-fig. 8). First, second and third leg claws strongly differentiated from fourth and from young. Table III gives comparisons with the other species.

Palp. (Text-fig. 9, A, B). Slender. Tibial apophysis of moderate length, stout, tip curved inward or straight, bluntly pointed; uneven, scarcely incised serrations in distal half, sometimes indistinguishable. Tibial ventral tubercle well developed. Whole of embolus occupying only distal fourth of bulb; stylus short, scarcely longer than shorter diameter of whorl; tip tapering to a point.

Epigynum. (Text-fig. 10, A, B). Smallest of the three forms under discussion, although the species is almost as large as *fulgipedia* and much larger than *xanthopa*. Viewed externally the horizontal extent of the anterior pair of dark spots is broader than that of posterior pair (spermathecae); their diameter is almost as large as that of spermathecae, and extend forward beyond

margin of bean-shaped patches. Breadth of entire epigynal plate less than diameter of a single AME.

Abdomen. No distinctive specific characters.

TABLE VIII.

C. chalcea.

Length Ranges and Averages in mm.

Instar	Carapace Length		Total Length	
	Range	Avg.	Range	Avg.
1st	.91-1.02	.93	1.81-2.11	1.94
2nd	1.09-1.27	1.16	1.81-2.69	2.21
3rd	1.23-1.57	1.39	1.91-2.78	2.41
4th	1.33-1.88	1.63	2.5-3.9	2.94
5th	1.64-2.15	1.95	2.7-4.4	3.52
6th ♀	2.26-2.57	2.39	3.8-5.5	4.3
6th ♂	2.47-3.06	2.69	4.0-6.0	4.8
7th ♀	2.39-3.12	2.83	4.4-6.0	5.3
Adult ♂	2.67-3.83	3.08	4.5-6.53	5.26
Adult ♀	3.11-3.56	3.42	5.86-7.0	6.7

SIZE AND GROWTH.

MEASUREMENTS.

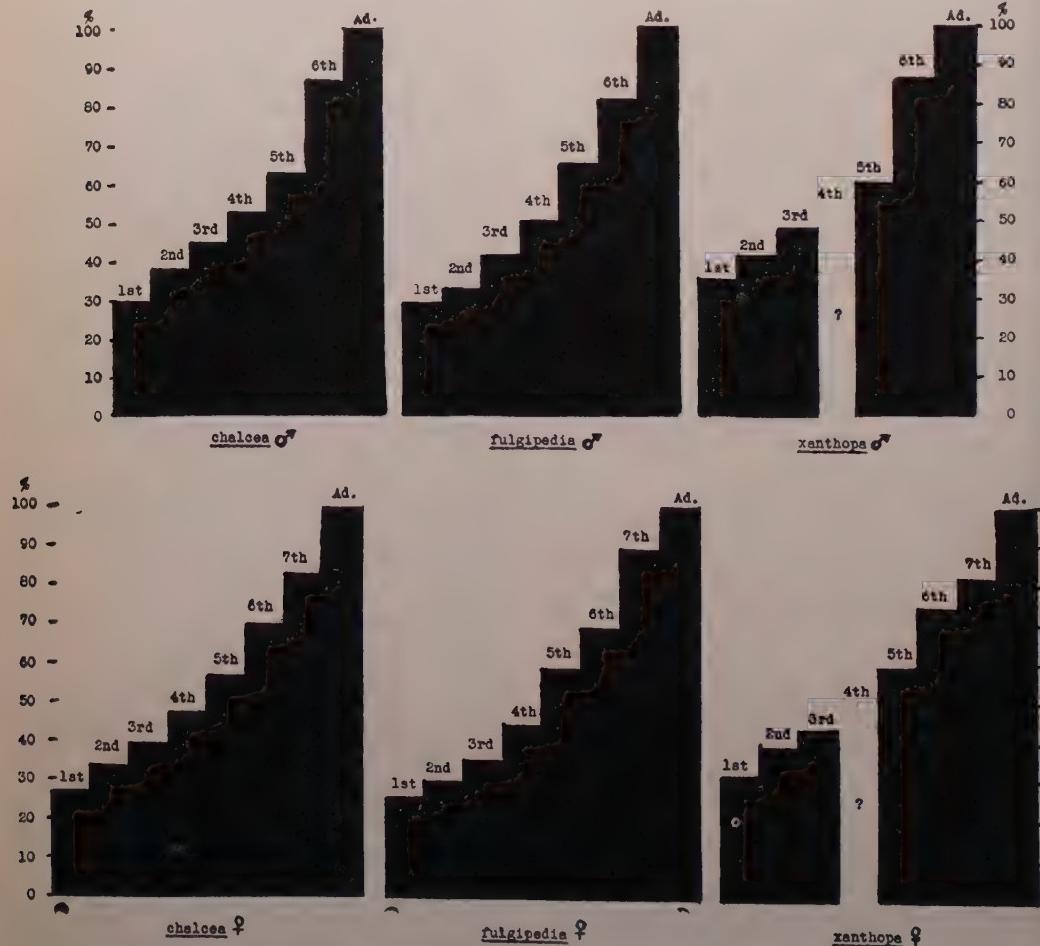
Table VIII gives the extremes and averages of carapace and total lengths of all specimens.

mens of *C. chalcea*. Table IV gives comparisons with the other species. The amount of relative growth in each instar is diagrammed in Text-fig. 11. Measurements in millimeters of the male holotype and female paratype are as follows:

Male holotype. Total length in alcohol 5.1 mm.; carapace length 3.1; carapace breadth 2.3; carapace height 1.5; ocular quadrangle length 1.3; ocular quadrangle breadth 1.9; diameter AME .58; ALE .36, MLE .10, PLE .36; clypeus height .31; 3rd patella breadth .43.

Leg	Femur	Pat.	Tib.	Metat.	Tarsus	Total
1st	1.7	1.0	1.2	.99	.55	5.44
2nd	1.7	1.1	1.1	.99	.51	5.40
3rd	2.4	1.1	1.4	1.6	.62	7.12
4th	2.1	.92	1.3	1.7	.65	6.67
Palp	.89	.41	.31	—	.75	2.36

Female Paratype. Total length in alcohol 5.9; carapace length 3.3; carapace breadth 2.5; carapace height 1.6; ocular quadrangle length 1.3; ocular quadrangle breadth 2.1; diameter AME .64, ALE .38, MLE .11, PLE .36; clypeus height .29; 3rd patella breadth .43.



TEXT-FIG. 11. Growth profiles in *Corythalia*. Based on average carapace lengths at each instar.

Leg	Femur	Pat.	Tib.	Metat.	Tarsus	Total
1st	1.7	1.0	1.1	.92	.55	5.37
2nd	1.7	1.1	1.0	.85	.55	5.20
3rd	2.1	1.1	1.3	1.4	.68	6.58
4th	2.1	1.0	1.3	1.5	.65	6.55
Palp	.96	.51	.48	—	.72	2.67

RECORDS OF INSTAR DURATION.

Egg: About 14 to 23 days; *first instar*: about 15 to 27 days; *second instar*: about 25 to 28 days (records of 5 broods); *third instar*: 4 members of 1 brood: 17, 19, 19, 19 days; other records, 18 days (δ); 32 days (δ); 41, 22-plus days (φ s); *fourth instar*: φ s, 17, 18-plus days; φ s, 24-plus days; *fifth instar*: δ s, 16, 19, 20, 24 days, φ s, 19, 20, 25 days; *sixth instar*: δ s, 23, 25, 27, 29, 52 days; φ s, 20, 23 days; *seventh instar*: φ s, 34, 39-plus, 41 days.

BEHAVIOR.

(Text-fig. 12; Pl. I, Figs. 1-3).

COURTSHIP DISPLAY.

DIAGNOSIS: *Stage I*. Body held high. Third legs elevated, extended straight out, and waved up and down in unison above the horizontal, during the rather direct running approach spurts. No posing; no rocking; palps motionless. *Stage II*. First leg held straight out in front, elevated, parallel.

DESCRIPTION: *Stage I*. Carapace elevated moderately high, although lower than distal ends of femora. Abdomen horizontal or slightly depressed. All legs except third remain on ground. Third legs elevated, the femur obliquely up as in other legs, and at peak display, raised from horizontal to oblique vertical, with femur-patella joint as hinge, the distal segments remaining straight. When display is not full, the wave arc is from highest point to ground, the tibial joints bending on the downbeat. The rhythm at optimum display consists of several running steps during which the third legs are raised, in unison, and the body held at its highest, followed by a pause while they are lowered (either partially or completely, as described above). Fourth leg braced farther out than in *fulgipedia*. Progress is fairly direct, with little zigzagging. There is no posing, motion being almost constant, nor rocking, and only rarely any vibration (see under *Variation*). The palps hang motionless and relaxed. *Variation*. In one rare individual, an up and down jitter, including a stamping with first feet, occurred at end of every forward movement.

Stage II. Cephalothorax elevated as in *Stage I*, abdomen perfectly horizontal, body sustained on three posterior legs while the first pair are held up and forward. To achieve this position, their femora are directed up, parallel and the legs bent straight forward at femur-patella joint, bringing them on a level with top of cephalothorax. *Variation*. If a not entirely receptive female raises her front legs straight up, the male may raise his vertically also, patting her tarsi with his.

If this completes her acceptance, he slides between hers on to the carapace, patting her as he goes. Even at this stage he may break away.

Female Behavior. A completely receptive female makes no display attempt at all, but watches closely, sitting crouched, and may or may not run away a few times before accepting male. No more than two or three minutes of display are required. A non-receptive female constantly runs away and/or attacks, leaping at the male again and again. A partially receptive female raises her first front legs forward as the male enters Stage II, and then sometimes upward (see above paragraph) before accepting or rejecting male. One highly receptive individual female, during a series of experiments on several successive days, performed a peculiar, crouching, rocking display toward the end of the male's Stage I and Stage II. All her legs remained on the ground. About the fourth day, still not having been permitted to mate, she gave up the motion, although she remained responsive as ever to the displays of various males, and was finally mated.

THREAT DISPLAY.

DIAGNOSIS: *Stage I*. Third legs elevated, straight or arched, to horizontal (but not above) and returned in arch to ground, during zigzagging or sidling spurts, which alternate with extended posing. No rocking or vibration. Differs from courtship in that third legs are not brought above horizontal and posing occurs. *Stage II*. First legs held straight overhead, fending off opponent. Differs from courtship in their higher position.

DESCRIPTION: *Stage I*. Carapace held moderately high, as in courtship, although in threat the abdomen hangs down. Also as in courtship, all legs remain on ground except third, which are waved up and down. However, these legs are practically never raised above the horizontal plane and usually do not reach this high, while the low point of every wave is the ground. There is more zigzagging and sidling back and forth than in courtship, where the approach is much more direct, the raised leg on the side of the momentary direction of approach being raised higher. Also there is extensive posing, the spider remaining motionless up to a half-minute, with the third legs either more or less elevated, stretched straight, or simply arched, whether touching or clearing the ground. Although this approaches a fan display, at no time is a perfect fan made by the fringes of adjacent legs, as in *xanthopha*. Fourth leg braced far out to side, as in courtship. Palps held more rigidly than in courtship, bent obliquely outward at patella. *Variation*. Some males have swung on the end of a silk thread to the attack. Usually they start display from not more than three inches away, but one individual leapt from a distance of eight inches.

Stage II. Usually one or the other of the



TEXT-FIG. 12. Peak of threat display in *C. chalcea*. Dotted lines indicate peak position of legs during Stage I of courtship display. Scales white except for russet eye rims; iridescence not indicated.

opponents retreats when within two inches, but occasionally they meet head-on after short leaps, in which case the third legs remain on ground while the first are raised straight in the air and slightly forward, touching the opponent's tarsi. Chelicerae not opened, nor even seem to touch, and no male has ever been seen to be injured. The meeting is always momentary only.

HABITS ASSOCIATED WITH BROODING.

Eggs are laid about seven to nine weeks after the final molt (records inconclusive). The second clutch of individual females is apparently laid about the time the first clutch is ready to molt; the third clutch appears when the second is hatching. The eggs, numbering 20 to 29 (3 perfect first clutches counted) are ivory yellow (Ridgway) and measure 1.06-1.2 mm. in diameter. Eggs of later clutches range from almost normal numbers down to half a dozen. The cocoon is spun in a small dead leaf; a typical example measures 25 × 18 mm., with the oblong inner cocoon surrounding the eggs 7 × 9 mm. The later clutches are apparently always laid in the same leaf, but data are scanty in this species.

HABITAT.

C. chalcea was taken only in the extreme upper margin of the semi-evergreen seasonal forest and in the lower part of the montane cloud forest at Rancho Grande, from about 1,000 to 1,300 meters. On its lower edges, the habitat overlaps that of *C. fulgipedia*. It was found principally on the ground, on dead leaves along the roadside, well lighted trails, and on the edges of clearings; however, a number of specimens were taken in bromeliads, and on the trunks of trees near these epiphytes, to a height of about 8 meters.

RELATIONSHIPS.

C. chalcea appears to be most closely related to *C. obsoleta* Banks, 1929, from Panama. It differs in the simpler banding of the female abdomen, in the poorly developed submarginal carapace band, in the lack of grooving in the male embolus and in details of the epigynum.

MATERIAL.

A total of 197 specimens of *C. chalcea* have been preserved, including exuviae. They are distributed as follows among the instars: first instar, 45; second, 28; third, 15; fourth, 10; fifth, 11; sixth, ♂s, 12; ♀s, 10; seventh, ♀s, 7; adult ♂s, 35; adult ♀s, 24. All were taken within a radius of half a kilometer of Rancho Grande. The following have been designated as holotype and paratype:

HOLOTYPE: Male. Cat. No. 461191, Department of Tropical Research, New York Zoological Society; Portachuelo, Rancho Grande, near Maracay, State of Aragua, Venezuela; 1,200 meters; cloud forest; May 10, 1946.

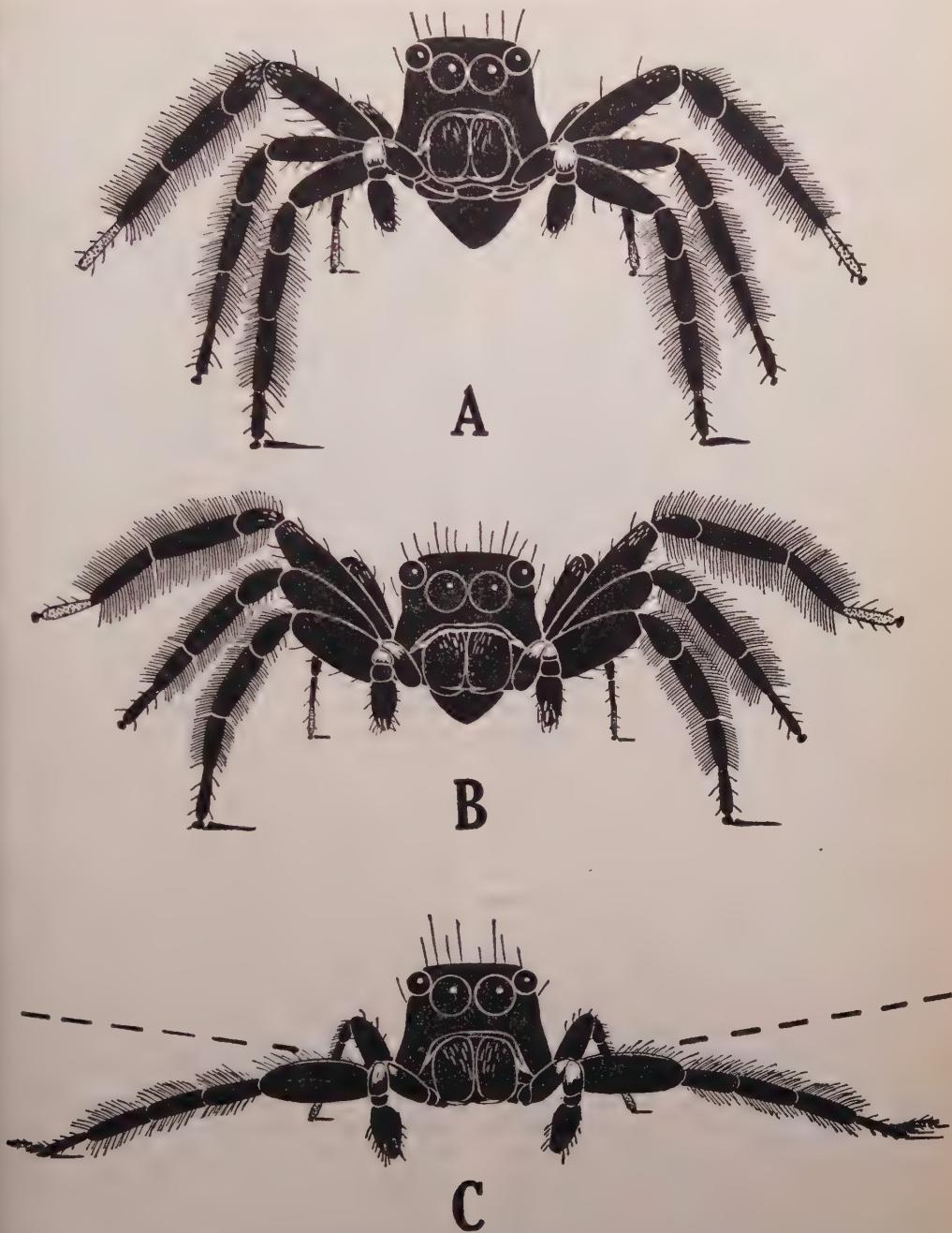
PARATYPE: Female. Cat. No. 461192, Department of Tropical Research, New York Zoological Society; same locality as holotype; May 23, 1946.

The name *chalcea* is proposed in reference to the bronze scales covering the male abdomen.

Corythalia fulgipedia sp. nov.

DIAGNOSIS.

Adults of both sexes with a strong, white submarginal carapace band; at least traces of 5 white spots on carapace plus a thoracic spot or concave band which may be present or absent; male with face and chelicerae almost naked; female with plentiful yellowish and white hairs and scales in these



TEXT-FIG. 13. Display in *C. fulgipedia*. A, peak of threat display; B, fan phase of threat and courtship; C, courtship, Stage 1; dotted lines indicate elevation limit of third legs. Scales white, except for orange or russet eye rims; iridescence not indicated.

areas; abdomen of both sexes banded successively with white, bronze, black, white, black and white, the white bands all confluent on sides; in alcohol only the second white band is usually persistent. Young with two abdominal bands and a pair of terminal spots pure matte white; dorsal carapace scales present from second instar, a strong submarginal band from third. Adults of both sexes with two femoral prolateral spines on first leg, and clearly more than 20 teeth on

its tarsal proclaw. Adult male with fringes well developed on first three legs and with a rudimentary thickening of hair on fourth. Tibial apophysis of palp serrated distally and truncate; tip of embolus forked; breadth of epigynal plate greater than diameter of one AME plus one ALE. Second and third legs, but not fourth, elevated during both courtship and aggressive display; rocking present in aggressive display only. Size moderate, total length of adult males around 5.5 mm.;

of females around 6.5 mm. Terrestrial only on forest roadsides and in open forest clearings in deciduous seasonal and semi-evergreen seasonal forests; occasionally on lower edges of montane cloud forest; about 700-1,100 meters.

EXTERNAL CHARACTERISTICS IN ADULTS AND YOUNG.

COLOR IN LIFE.

(Text-figs. 2, I-Q; 13; 15B).

ADULT MALE: *Cephalothorax.* Integument black. Ocular quadrangle with or without a sparse scattering of yellowish or bronzy scales, usually concentrated around dorsal eyes. There are always 5 white spots in this general region; a pair in front of PME, a pair behind PLE and a median spot between PLE. In addition yellowish or pale tan scales are present or absent on anterior thorax; in the simplest form they make a median spot at beginning of posterior thoracic slope; in greatest extent they form a crescent in this region merging anteriorly with spots behind PLE. A strong pure white carapace band, beginning at level of PME, stopping short of pedicel. AME and ALE unchanging dark brownish-black, rimmed with rust-colored scales. Clypeus completely naked; a few variable white hairs and scales at base of chelicerae; a moderate number on distal part of femur and on patella of palp with scattered long white hairs near tip of tarsus. Legs: Integument black except for slightly paler third and fourth tarsi. First and second legs with a few white scales on dorso-posterior surfaces of patella and basal tibia and metatarsus, rarely on distal femur as well; third and fourth legs with scales much more plentiful, distinctly yellowish, on posterior surfaces of distal part of femur, entire patella, entire tibia, and base of metatarsus; anteriorly on distal femur and patella only.

Abdomen. Anterior band with a variably narrow anterior margin of white, and a broader posterior bronze portion; contiguous to this posteriorly is usually a small median yellowish-white spot; second band white slightly concave forward the anterior edge wavy or plain and the band marked in its center with a short, black bar. Behind second band is a narrow, median, white stripe linking second band to white or yellowish terminal markings, which are usually in form of a wavy narrow band, curving forward or broadly V-shaped. All transverse white bands on abdomen curving to connect with one another high up on the white sides. Venter plentifully clothed in grayish hair.

ADULT FEMALE: Like male except that there are more light scales and hairs on ocular quadrangle, face, palms and legs. Details are as follows: *Cephalothorax.* Ocular quadrangle almost always with a general frosting of dull bronze scales often with a

short median line of white scales behind AME; 5 white spots as in male, behind each ALE, each PME and in midline between PLE; anterior thoracic markings, as in male, ranging from none through a median spot (sometimes represented only by several scales) at beginning of thoracic slope, to a complete crescent, concave forward and merging with PLE spots; these thoracic scales usually have a creamy or tan tinge. A strong, pure white submarginal carapace band exactly as in male. Pale tan short hairs and scales all across clypeus below AME and ALE, and a double row of pure white hairs across edge of clypeus. Thick, pure white hairs also on chelicerae and on palp across distal part of femur and entire patella; palp tibia and tarsus heavily covered with tannish-white, except for black tarsal tips. Legs: integument jet black, except for slightly paler first and second tarsi and definitely paler third and fourth. All segments plentifully covered, both anteriorly and posteriorly, with tannish-white scales except coxae, trochanters at joints, dorsal median parts of patellae and tibiae and entire tarsi. However, coxae beneath are well scaled as is underside of the black sternum. *Abdomen.* Like that of male, except that second white band is convex, not concave, anteriorly while the posterior median stripe is often broken. Venter well covered with grayish hair.

YOUNG; FIRST INSTAR: Typical of *Corythalia*: true pigment lacking, but with the usual two dark abdominal bands clearly visible in latter part of stadium.

SECOND INSTAR: This is the only species in which carapace scales appear before third instar. The black integument and basic pattern of two abdominal bands and a pair of terminal spots are typical of the group. Carapace: large, elongate white scales scattered over entire ocular quadrangle and extending behind it either as a more or less complete band, or as a simple spot behind each PLE. AME bordered with a few rust scales. Clypeus, mouthparts and sternum black. Palps, legs and spinnerets translucent buff with, however, faint dark bands appearing at the leg joints. Abdomen: the bands are dull (not shining) pure white, even, the anterior slightly narrower than the posterior. Venter dark gray.

THIRD INSTAR: All markings dull white, except sometimes for a very faint yellowish tinge on scales on anterior part of ocular quadrangle. These scales are concentrated into obscure oblique lines, thickest behind PME; they are very sparse in posterior part of ocular quadrangle and behind ALE. Between and behind PLE is a short median streak, and a well marked spot behind each PLE. A strongly developed carapace band begins at level of posterior eyes, stopping short of pedicel; this band continues, unchanged, except for further broadening and strengthening, and a slight extension forward, from this instar on. Anterior eyes rimmed with rust except outer margin of

ALE. The clypeus has a double row of white scales and hairs, the upper represented only by a short line below each AME, the lower is the usual submarginal band, the hairs directed inward, with longer ones centrally; a few white scales at inner base of chelicerae and many white scales and hairs at tip of palp femur and all over patella. Palp and legs all black with only faint traces of light bands on patellae, tibiae and metatarsi; tarsi may be dark basally. White scales moderately well developed dorsally at tips of all femora, on patellae, and in distal half of third and fourth tibiae. Abdomen above with the usual two bands of dull white, without jagged edges, the second more convex posteriorly than anteriorly; in midline behind second are a very few white scales; in midline in second band a short, curved black bar is indicated; two terminal spots, oval and well separated. Venter black, without light scales.

FOURTH INSTAR: Carapace as in preceding instar; the scalation on ocular quadrangle is rather variable in extent but is never dense except in the spots near PME and behind PLE, as well as the streak between PLE. ALE now completely rimmed with rust scales. Clypeus, chelicerae and palps as in preceding stadium. Legs all dark except for pale tarsi, and sometimes pale posterior patellae; white scales on legs about as in preceding stadium. Abdomen with two even, simple, white bands with a dark horizontal bar in second, followed by a line of midline scales and a pair of terminal spots, as in preceding stadium; in addition, however, there is a slight median, black invagination in posterior margin of first band.

FIFTH INSTAR: In this stadium the coloration becomes almost identical with that of the adult female because of the following additions and changes since the fourth instar: there is now a general coating on the ocular quadrangle of white, faintly yellowish or bronzy scales, through which the primary white spots are still visible near PME and behind PLE; the median streak between PLE is now divided into two spots, one between PLE and one at beginning of thoracic slope, although either one (but not both) may be lacking. White scales and hairs on clypeus, chelicerae, palps and legs are more numerous than in preceding stage, but still not as widespread and thick as in adult female; palp scales are now present on tibia as well as patella and distal femur; leg scales now occur on all segments except tarsi, especially on dorsal and anterior surfaces; palp integument remains pale except for tarsi; legs black except tarsi. Abdomen with bronze now apparent in posterior part of first band, although it is not nearly as well developed as in succeeding stadia; in this instar also appears the small streak or spot of white or yellowish hairs in midline behind the first band. Second band with median bar well marked, median streak following band well developed; posterior markings persisting

either as the primary spots or joining in a wavy band as in later stadia.

SIXTH INSTAR: Although sex can now be told through the form of the palp, there are no differences in color apparent, both sexes being identical with the adult female except that white scales on face and appendages are not so well developed. The carapace markings vary just as in the adult, both in color (from dull white to yellowish) and in extent of scalation, and this is the first stadium in which a crescentic marking outlining the postocular plateau region of the thorax may be present; it seems that if it is to be present in the adult it appears in this stage; if, on the other hand, the thoracic marking is to be a simple median spot, this spot is retained throughout. Tarsi almost as dark as other segments. Median whitish or yellowish patch in midline following bronze portion of first abdominal band present or absent. Terminal abdominal markings variable, the median marking complete or broken, the primary spots completely joined or practically separate; bands curving on sides toward each other, but rarely merging as completely as in final stages. Sternum and abdomen beneath well covered with white scales.

SEVENTH INSTAR: (Female only). Like adult, including amount of variation, except that there is still not quite the profusion of white scales in frontal aspects and on legs.

SUMMARY OF COLOR DEVELOPMENT IN *C. fulgipedia*: *Integument*. Carapace, mouth-parts and sternum black in second instar, as usual. Palps begin to darken in third, are not completely dark until fifth. Legs moderately banded in second; color complete in fifth. Abdomen black above (with two usual subscale pale bands and terminal spots) in second; venter black in third. *Light-colored scales and hairs*. Carapace above has white primary scale-hairs in second; by third the most prominent 5 patches correspond in position to the 5 constant spots of adult; a general white, yellowish or bronze frosting (secondary scalation) begins in third; separate thoracic spot or crescent, if present in adult, appears in fifth or sixth. Sub-marginal carapace band appears in third and is strong even in that early instar. AME first rimmed with rust in second, ALE in third. Light scales appear first on clypeus, chelicerae, palps and legs in third, reaching maximum development in preadults of both sexes. Abdomen with two sharp bands and a pair of terminal spots pure, dull white until fifth, when a very faint cast of bronze may appear over posterior part of first band; sometimes the bronze does not appear until sixth. Second band with a dark horizontal median bar in third and subsequent instars. Median whitish spots or short stripes following each band appear in fifth; terminal spots merge into an irregular band, and all bands are confluent on lateral margins from sixth on. White or grayish scales appear on venter in fourth or fifth.

STRUCTURE.

With the characteristics described on pp. 3 ff.

In contrast to color development, the course of post-embryological development of structure shows no clear distinctions from that of the closely related *chalcea*, except in the earlier appearance of some of the spines. The discussion below therefore concerns adults only except where otherwise specified. Ranges and averages of proportions of adults are given in Table IX, and comparisons with the other species in Table I.

Carapace. Height less than half of length; anterior part of thoracic profile a plateau. Anterior width of ocular quadrangle much narrower than width of carapace. Width at level of second-to-third coxa much greater than that at bulge before PLE.

Eyes. All eyes definitely smaller than in either of the other species. PME about midway between ALE and PLE.

Clypeus. Half or slightly more than half diameter of AME.

Chelicerae. Two minute teeth on promargin.

Maxillae. Outer margin distinctly concave; tubercle well developed.

Lip. No distinctive specific characters.

Sternum. As in *chalcea* width three-fourths of length in male, slightly less in female; not quite as wide anteriorly as base of lip; lateral excavations well developed.

Bristles. No distinctive specific characteristics.

Legs. Third leg usually longer than fourth leg in both males and females; second leg longer than first leg in all males and in more than half of females. In the formula, Table X, the alternate order is expressed by the figures in parentheses in upper row; figures of proportions are averages; for range of variation see Table IX. Segments thicker and broader in relation to their length, and length relatively shorter than in either *chal-*

cea or *xanthopa*, particularly in female. Tibial index: first leg, males 25 to 27, females 27 to 33; fourth leg, males 17 to 21, females 21 to 27.

Both iridescence and luxuriance of fringe reach their highest development in the present species, compared with the other two. Iridescence is present on first three legs, but altogether absent on fourth. The correlated flattening of the surfaces is greater than in either of the other species. Fringes also are present only on the first three legs, although on the fourth there is some thickening and a very slight elongation of the profile hairs. In detail, the fringes are as follows: *First leg:* femur: ventral only; short, downy, chiefly on posterior surface. Patella. Dorsal short and scanty, ventral moderate, anterior, slightly less than length of segment. Tibia: like patella. Metatarsus: no true fringe, but plentiful long hairs. *Second leg:* like first leg, but longer and thicker on all segments,

TABLE X.
C. fulgipedia: Leg Formula.

	3(4)	4(3)	2(1)	1(2)
Males	2.06	2.04	1.70	1.66
Females	1.81	1.86	1.51	1.48

and very well developed on metatarsus. *Third leg:* maximum development. Like second, but longer and thicker, except on femur, where it still does not constitute a true fringe, since it is composed of soft, pale hairs, well separated. Dorsal fringe of the three true, fringe-bearing segments always only about half as long as ventral, and always thinner, the difference being most noticeable on this leg. Dorsal fringe best developed in all three legs on metatarsus. Ventral tibial fringe of graduated length, the longest hairs coming at middle of segment, which is also widest part. This is true also of second tibia. The longest fringe is about as wide as widest part of tibia. *Fourth leg:* the profile hairs of the middle segments, although very short and

TABLE IX.
Relative Proportions in *C. fulgipedia*.

	Males		Females	
	Range %	Average %	Range %	Average %
Carapace Length: Breadth	72-77	74.0	69-75	72.0
Carapace Length: Height	45-51	48.0	47-50	48.4
Carapace Length: Oc. Quad. Length	35-43	37.8	34-38	36.4
Carapace Length: Oc. Quad. Breadth	55-60	57.2	53-58	56.0
Carapace Length: AME Diameter	16-19	17.2	17-18	17.4
AME Diameter: ALE Diameter	59-71	63.2	55-59	57.8
AME Diameter: MLE Diameter	19-23	21.4	18-22	19.4
AME Diameter: PLE Diameter	52-60	56.0	49-53	50.6
AME Diameter: Clypeus	53-56	54.0	53-62	55.6
Carapace Length: 1st Tibia	32-34	32.8	27-30	29.0
Carapace Length: 2nd Tibia	34-35	34.8	28-36	29.8
Carapace Length: 3rd Tibia	34-42	39.2	30-34	32.4
Carapace Length: 4th Tibia	36-42	39.8	36-37	36.8
Carapace Length: 1st Metatarsus	30-33	30.8	23-25	23.8
Carapace Length: 2nd Metatarsus	27-31	29.8	24-27	25.6
Carapace Length: 3rd Metatarsus	44-47	45.8	36-39	37.6
Carapace Length: 4th Metatarsus	46-51	48.4	41-43	42.2
Carapace Length: Palp	77-89	81.0	79-81	79.6

weak, are thickened enough to be termed a fringe, especially on ventral surfaces. There are rudimentary fringes on all tarsi, although the hairs are pale, and longer on dorsal, not ventral surfaces.

Spines. There are no invariable spine differences separating *fulgipedia* from *chalcea*, nor the sexes from each other. Comparisons of the three species, with variables, are given in Table II. The order of spine development in this species follows the general outline given on p. 7; details are given for *chalcea* on p. 18 and in Text-figs. 2, 7. Here it is to be noted that although they appear in the same order, certain spines appear one or more instars earlier in *fulgipedia* than in either of the other two species. The second instar spines are identical for both species, except that in *fulgipedia* the second metatarsal ventrals are 2-2, not 1r-2, and, in one example, a third patellar prolateral occurs. In the third instar appear the following spines, which do not appear in *chalcea* until the fourth or fifth; femoral distal upper prolaterals; all patellar prolaterals; third and fourth patellar retrolaterals; some tibial distal ventrals. In the fourth instar of *fulgipedia* most spines are present which typically appear in the fifth of *chalcea*; the third and fourth tibial median prolaterals and corresponding retrolaterals are exceptions, however, since they do not appear until the fifth. In the fifth instar of *fulgipedia* the acceleration of development in comparison with *chalcea* loses its impetus, since about the same spines are present in that stage in both species, and the same is true, including the high variability, of the sixth (both sexes) and seventh (female) instars.

Trichobothria; Long, Dark Bristles; Short, Pale Bristles. No distinctive specific characteristics.

Tarsal Claws. As in *chalcea*, the first, second and third leg claw-teeth strongly differentiated from those of the fourth and of the young. Table III gives comparisons with the other species.

Palp. (Text-fig. 9, C, D). Robust. Tibial apophysis very broad, compressed along dorso-ventral axis, the end obliquely truncate, with the low corner dorsad; tip irregularly serrated. Whorl of embolus large, occupying almost distal two-fifths of bulb; stylus long, broad, tapering; tip shallowly forked, the tines unequal.

Epigynum. (Text-fig. 10, C, D). By far the largest of the three under discussion. Viewed externally, the horizontal extent of the clearly visible portion of anterior pair of dark spots is a little less broad than that of posterior pair (spermathecae); they extend to anterior edge of bean-shaped patches. Subdermally, the structure is seen to be almost identical with that of *chalcea*, except for size. Breadth of plate greater than diameter of one AME plus one ALE.

Abdomen. No distinctive specific characters.

SIZE AND GROWTH. MEASUREMENTS.

Table XI gives the extremes and averages of carapace and total lengths of all specimens of *C. fulgipedia*. Table IV gives comparisons with the other species. The amount of relative growth in each instar is diagrammed in Text-fig. 11. Measurements in millimeters of the male holotype and female paratype are as follows:

Male holotype. Total length in alcohol 5.7 mm.; carapace length 3.5; carapace breadth 2.5; carapace height 1.7; ocular quadrangle length 1.2; ocular quadrangle breadth 1.9; diameter AME .59; ALE .34, MLE .09, PLE .28; clypeus height .31; 3rd patella breadth .54.

	Leg	Femur	Pat.	Tib.	Metat.	Tarsus	Total
1st	1.9	1.1	1.2	1.0	.54	5.74	
2nd	1.9	1.1	1.1	1.0	.54	5.64	
3rd	2.3	1.2	1.5	1.6	.70	7.30	
4th	2.3	1.0	1.3	1.6	.70	6.90	
Palp	1.0	.48	.27	—	.97	2.72	

TABLE XI.
C. fulgipedia.

Length Ranges and Averages in mm.

Instar	Carapace Length		Total Length	
	Range	Avg.	Range	Avg.
1st	.86-.97	.91	1.72-2.15	1.86
2nd	.96-1.13	1.06	1.54-2.02	1.77
3rd	1.27-1.4	1.32	2.3-3.0	2.49
4th	1.47-1.81	1.59	2.5-3.9	3.22
5th	1.88-2.19	2.07	2.9-4.1	3.68
6th ♀	2.33-2.67	2.41	3.55-4.9	4.23
6th ♂	2.12-2.84	2.62	3.4-5.28	4.49
7th ♀	2.84-3.15	3.00	4.9-6.24	5.53
Adult ♂	2.8-3.63	3.19	4.61-6.14	5.43
Adult ♀	3.28-4.0	3.59	5.76-7.2	6.53

Female Paratype. Total length in alcohol 7.7 mm.; carapace length 3.8; carapace breadth 2.7; carapace height 1.8; ocular quadrangle length 1.3; ocular quadrangle breadth 2.1; diameter AME .59; ALE .34, MLE .11, PLE .28, clypeus height .34; 3rd patella breadth .54.

	Leg	Femur	Pat.	Tib.	Metat.	Tarsus	Total
1st	1.9	1.1	1.1	.91	.59	5.60	
2nd	1.9	1.2	1.0	1.0	.54	5.64	
3rd	2.2	1.1	1.3	1.4	.75	6.75	
4th	2.2	1.1	1.3	1.6	.75	6.95	
Palp	1.1	.48	.54	—	.86	2.98	

RECORDS OF INSTAR DURATION.

Egg: About 8 to 16 days: **First instar:** more than 12 to less than 31 days (no exact records); **second instar:** 20, 21, 25, 25 and 31 days; **third instar:** 19, 19 and 20 days (specimens taken to New York laboratory: 30, 34 and 42 days); **fourth instar:** the only complete records are of specimens taken to New York: 33, 35 and 37 days; judging by the delayed molting in New York of the other stadia, the normal time is much less, probably around three weeks; **fifth instar:** 22, 27-plus days (both ♂s); in New York laboratory, 67 days (♂); **sixth instar:** ♀s, 20-plus,

27-plus days; ♂s, 26, 26-plus, 34, 34-plus days; New York laboratory, 41 days (♂); seventh instar (♀s); 35-plus, 37, 46, 50 and 61 days.

BEHAVIOR.

(Text-fig. 13).

COURTSHIP DISPLAY.

DIAGNOSIS. *Stage I.* Body held low, with legs wide spread laterally; third legs intermittently raised and vibrated in unison with body during or between spurts of progress. No posing; no rocking. Palps jerked, in unison, almost constantly.

Stage II. As in *chalcea* but body held lower, and there is vibration.

DESCRIPTION: *Stage I.* Cephalothorax held very low with first three pairs of legs stretched progressively farther out to side, so that the femora are parallel with ground and the tarsi show one behind the other; only the fourth legs are extended behind, not laterally, for balance. Abdomen horizontal. All legs left continually on ground except third which are intermittently moderately elevated and vibrated in the air, up and down, in a small arc in unison with vibration in the body, especially the abdomen. The vibration—of about a second's duration—takes place either between or during spurts of rather direct progress. There is no posing and no rocking. The palps are jerked up and down almost continuously, usually with a roughly circular motion, one going clockwise as the other goes counter-clockwise, and vice versa; sometimes it is more of a simple jerking up and down. As the female becomes more receptive the elevation of the third legs almost ceases and the male approaches with the cephalothorax even lower, almost touching ground. *Variation.* Some individuals lower the body regularly more than others.

Stage II. As in *chalcea*, with first legs out in front, parallel, level with top of cephalothorax, but the body is held lower, and the same type and rhythm of body vibration occurs as in Stage I. He may in this stage, practically touching female, pose utterly motionless if she fences with him, but does not actually run.

THREAT DISPLAY.

DIAGNOSIS: *Stage I.* Body held exceptionally high, second and third legs raised intermittently, the second just clearing ground, the third higher, bent at patella only, or arched. No vertical vibration, but occasional side-to-side coarse rocking; a moderate amount of posing with raised third legs. Palps jerked at intervals.

DESCRIPTION: *Stage I.* Position exactly opposed to courtship display, the cephalothorax elevated to maximum extent through the legs, especially first and fourth, being held in close to body and stretched to maximum vertical; at peak display the first femur slants forward and strongly downward. Sec-

ond legs and third legs extending progressively further laterally. Toes of second legs not touching ground at peak display, and third legs raised and bent only at the femoropatella joint which is raised above level of cephalothorax, the more distal joints held straight at an obliquely downward angle. At less than peak display the cephalothorax is lower, and the leg more arched, its fringes never, however, forming a perfect fan with those of first and second. Fourth leg braced far back. There is no trace of the up-and-down vibration typical of courtship, but some intermittent coarse rocking between spurts of zigzag progress, usually about six rocks (three to each side)—occupying about a second or less—in a series. There is more zig-zagging and sidling than in courtship, and the raised leg on the side of direction of rocking or progress is raised higher. Posing plays a moderate part in threat display, the third legs being usually in the arched, not maximum obliquely bent, position. Palps jerked as in courtship at beginning of threat, but held motionless at peak, with femur bent out and the other segments hanging down.

Stage II. As in *chalcea*.

Female Behavior. A completely receptive female practically always raises first front legs forward as male enters Stage II, as does the only partially receptive *chalcea* female. A non-receptive female is more combative than a non-receptive *chalcea* female, usually leaping on the male savagely, after hunching her body well down between her close-gathered legs and rocking violently back and forth; if these tactics fail to discourage him—they usually scare him away quite quickly—she will leap, then run away. So far no female has actually hurt a male in this group. A potentially receptive female alternately leaps, sits, and runs away, punctuating these activities with rough versions of the male threat, and as in *chalcea* she raises her first legs first forward and then sometimes upward, although her arched-out second and third legs apparently never actually leave the ground.

HABITS ASSOCIATED WITH BROODING.

Each of several females which molted and mated in the laboratory laid eggs between eight and nine weeks after molting, and between three and nine weeks after mating. The second clutches were apparently laid just about the time the first clutch was hatching. Since the former was laid, in its own inner cocoon, within the same leaf and outer cocoon as the first clutch, it was impossible to obtain exact data on these broods without unduly disturbing the female and young. We have two examples of a third clutch also laid in the same cocoon, just about the time the first brood was leaving the nest.

A single leaf is always used for the cocoon which is more extensive than that of *C. chalcea*. Bits of earth are mixed with the silk binding the edges together. A typical leaf

measures 70 mm. long, and the outer cocoon silk binds its whole length together; each egg packet is about 7 mm. in diameter. The eggs, numbering 13 to 28 (6 perfect first clutches counted) are ivory yellow (Ridgway) and measure .98 mm. in diameter. Eggs of second and third clutches have from 2 to 5 eggs fewer than those in the preceding clutch.

HABITAT.

C. fulgipedia is typical of relatively open savanflitter in the deciduous seasonal forest, although individuals occur on up through the semi-evergreen seasonal forest across the lower boundaries of the cloud forest along the well-lighted and intermittently dry roadside. In this upper zone its range overlaps that of *C. chalcea*, but it occurs typically only in the drier localities. The altitude range is between 700 and 1,100 meters. It is completely terrestrial.

RELATIONSHIPS.

C. fulgipedia shares with a large group of species the possession of well-formed fringes on the first three legs and a strong cephalothoracic band; the dorsal cephalothoracic markings in the female check closely with those of *spiralis*, *bicincta* and *opima*, from Central America and Panama (see especially Chickering's keys and descriptions, 1946). The species appears most closely related, however, to *C. blanda* (Peckham, 1900) from Trinidad, and *C. panamana* Petrunkevitch, 1925, from Panama. It differs from *blanda* in the absence of red hairs on the clypeus and in the form of the palpal tibial spine. The abdominal pattern appears identical with that figured by Peckham for *placatus* from Brazil, and the palps are also similar (Peckham, 1901, pls. xxv, fig. 11, xxvi, fig. 2). It differs from *panamana* as follows: the first leg tibial ventral spines are 1r-2-2, not 2-2-2; the tibial spine of the palp is truncate in a lateral view and the embolus is cleft distally; the epigynum is slightly different, although obviously similar to those of both *panamana* and *obsoleta* (cf. Chickering, 1946, fig. 133); and the dorsal carapace markings are apparently better developed. *C. fulgipedia* is smaller than either *blanda* or *panamana*.

MATERIAL.

A total of 142 specimens of *C. fulgipedia* have been preserved, including exuviae. They are distributed as follows among the instars: first instar, 35; second, 36; third, 8; fourth, 8; fifth, 7; sixth, ♀, 4; sixth, ♂, 9; seventh, ♀, 6; adult, ♀, 15; adult, ♂, 14. All were taken within a radius of two kilometers of Rancho Grande. The following have been designated as holotype and paratype:

HOLOTYPE: Male. Cat. No. 461193, Department of Tropical Research, New York Zoological Society; roadside between Guamitas and Rancho Grande, near Maracay, State of Aragua, Venezuela; deciduous seasonal forest; 900 meters; June 30, 1946.

PARATYPE: Female. Cat. No. 461184, Department of Tropical Research, New York Zoological Society; same location as holotype; July 12, 1946.

The name *fulgipedia* is proposed in reference to the brilliant iridescence on the legs of the male.

Corythalia xanthopa sp. nov.

DIAGNOSIS.

All light scales and scale-hairs on carapace and abdomen yellow in life, creamy to brown in alcohol, in both sexes and in young; no submarginal cephalothoracic band in adult of either sex. Adult male with long, thick hairs on palp and clypeus making bright yellow band in life (pale yellow to cream in alcohol); abdomen above entirely bright yellow (brownish in alcohol). Adult female clypeus with pale hairs or scales completely lacking, abdomen black medially, flanked in life by a pair of broad longitudinal yellow stripes, which persist subdermally and in alcohol as pale areas. Both sexes in adult with one femoral prolateral spine on first leg and clearly fewer than 20 teeth on its tarsal proclaw. Adult male with fringes on all legs though they are weak on first; dorsal fringe of fourth leg in life formed principally of yellow hairs. Tibial apophysis of palp non-serrate, pointed; embolus tip pointed. Courtship and aggressive displays sharply distinct, the fourth leg being elevated during aggressive display only. Size small, total length of adult males around 4 mm., of females around 5 mm. Terrestrial on trail and forest edges; semi-evergreen seasonal and lower part of montane cloud forests; 740-1,100 meters.

EXTERNAL CHARACTERISTICS IN ADULTS AND YOUNG.

COLOR IN LIFE.

(Text-figs. 2, R-X, 14, 15 C).

[All yellow mentioned below is straw yellow (Ridgway)].

ADULT MALE. *Cephalothorax:* Carapace integument black with a faint small patch of yellow hairs on each side between AME and ALE. AME and ALE unchanging black rimmed with yellow hairs. Short and fairly long yellow hairs densely covering black integument of clypeus and inner distal half of chelicerae, which may be spotted with brown proximally; yellow hairs all directed toward the center. Mouth-parts and sternum black. Palp integument black except for pale distal half of femur and entire patella and tibia, which are also covered densely with long yellow hairs. All legs black, except for tarsi, including ventral fringes and all dorsal fringes on fourth leg. Fringes on patella, tibia and metatarsus of latter formed mostly of yellow hairs with a few black. All tarsi pale, yellowish or brown, not black, the first

and second pairs darker than third and fourth. No white or yellow scales on legs. Iridescence in usual locations and, in addition, in same positions on fourth leg. *Abdomen*. Integument black, entirely covered dorsally with yellow scale-hairs which appear brighter than straw yellow because of their shininess; a suggestion of a distal yellow chevron; a scattering of long black and pale hairs projecting through scale-hairs. Venter black with dark brown striations in indistinct stripes.

ADULT FEMALE: *Cephalothorax*. Carapace integument black with a few yellow hairs irregularly outlining ocular quadrangle. Eyes black rimmed with yellow. Clypeus naked. Chelicerae and mouthparts black. Palps black except for distal part of femur and entire patellae which are pale. Sternum black. Legs black except for distal half of metatarsi and all tarsi, which are brown. No white or yellow scale-hairs.

Abdomen. Above, black, with a pair of long broad stripes of yellow scale-hairs extending two-thirds of distance to posterior tip and beginning at highest point on outer margin of dorsal surface. Behind these a pair of indistinct yellow spots, or, rather, the yellow stripe is interrupted on each side by a black spot joined to its fellow by an indistinct yellow band. Lateral stripes often partly interrupted farther forward by two other, partially isolated spots; a few black and pale hairs as in male. Venter, black except for a pair of ovoid yellowish patches spotted with black.

YOUNG; FIRST INSTAR: Typical of *Corythalia*: true pigment lacking but with the usual two abdominal bands clearly visible in latter part of stadium.

SECOND INSTAR: From this point on, the species is distinct in having all light carapace and abdominal markings yellow, not white and bronze, and in the tardy development of leg pigment. The black integument (dark brownish-gray on abdomen in early second instar) and basic pattern of two abdominal bands are, however, typical of the group. Second instar, carapace: scales and light hairs lacking except for a very few long pale hairs around lower margin of AME. Clypeus, mouthparts and sternum black. Palps, legs and spinnerets translucent buff. Abdomen: the bands are very pale yellow, each composed of a single row, in this stadium, of large-diamented scale-hairs of unequal length, giving a characteristic uneven, scraggly appearance to the bands; longer hairs in the anterior band near middle project posteriorly; anterior wider than posterior throughout instars; here it is straight, while the second is slightly wavy with an anterior median peak; neither curves forward or back on sides. Two terminal abdominal spots though present, are inconspicuous. As usual, there is pale integument beneath bands and spots. Venter apricot brown.

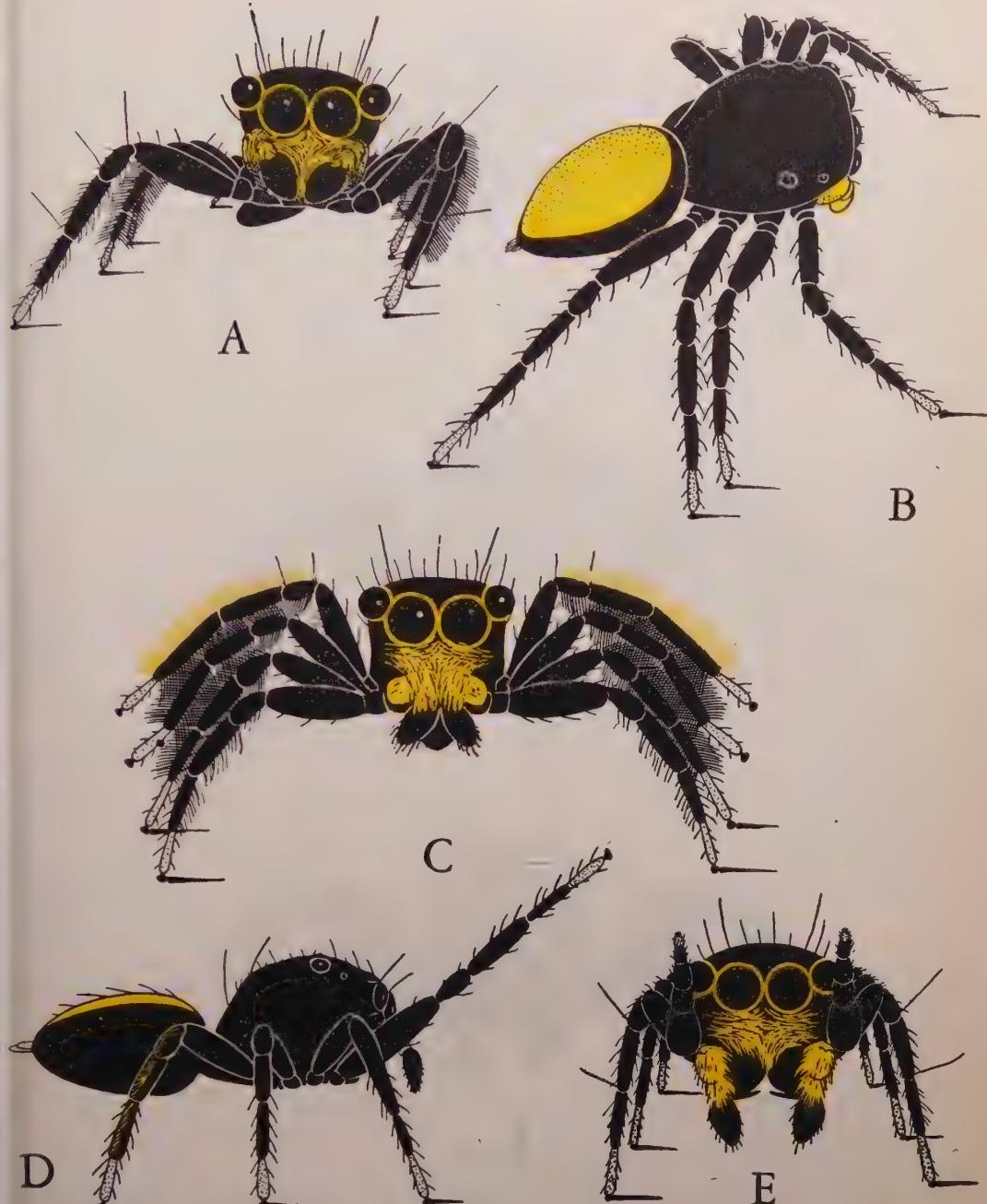
THIRD INSTAR: Carapace with a tiny pale

yellow spot behind each PLE, sometimes absent; appendages and abdomen as in preceding stage.

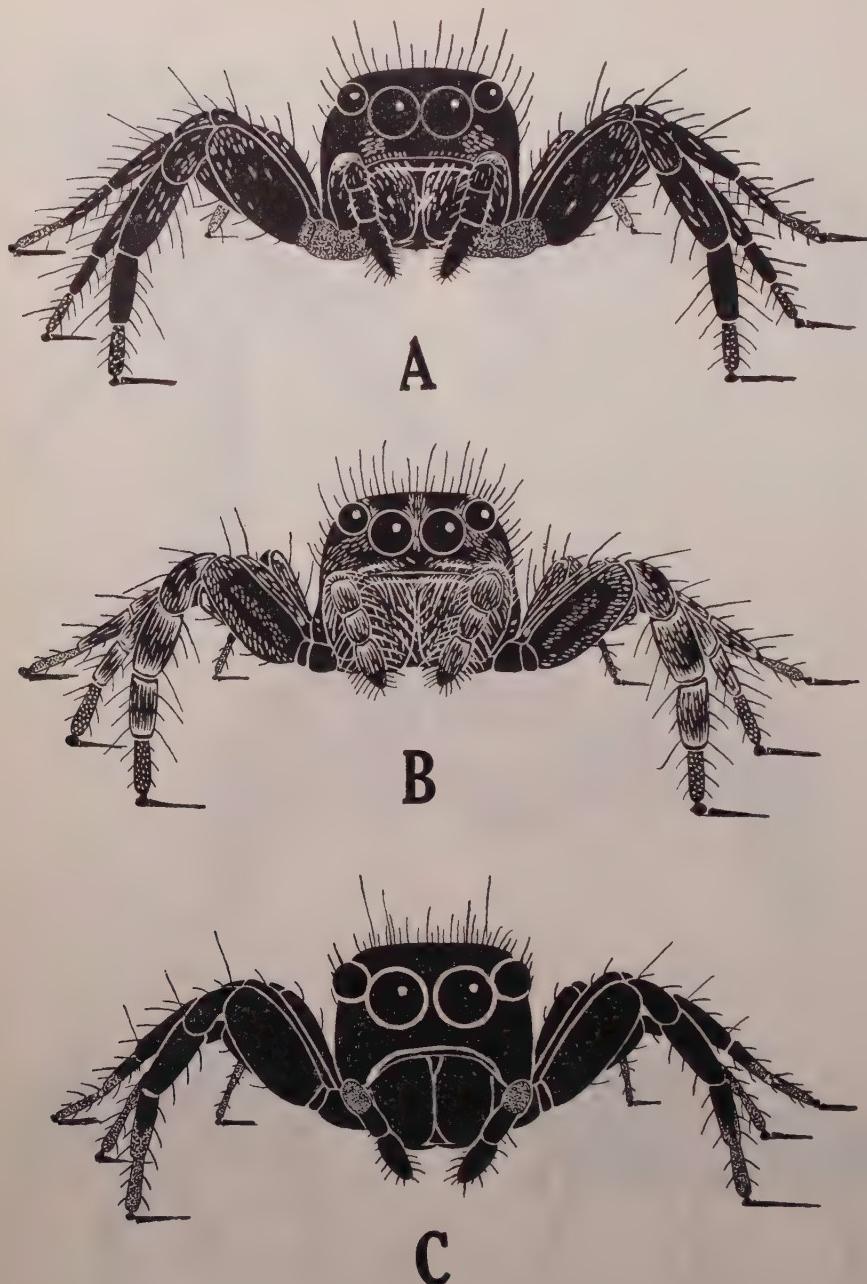
FOURTH INSTAR: Unknown.

FIFTH INSTAR: Carapace with a few yellow hairs on ocular quadrangle, sometimes numerous enough to form a faint band between PME, or there is only a spot around each PME, with another in middle anterior part of ocular quadrangle; behind each PLE a yellow spot as in preceding stadia, or an almost complete bar. AME and ALE rimmed narrowly with yellow; clypeus still naked; palp translucent; legs either still translucent or banded strongly. Abdomen as in preceding stadia, but bands are now relatively narrower and tend to approach each other on sides. Venter light brown, spotted and blotched irregularly with dark brown.

SIXTH INSTAR, MALE AND FEMALE: *Cephalothorax*: Dorsal part of carapace marked very variably with yellow, the variability depending not only on wear, but on individual differences, since fresh-molted specimens may appear quite different, regardless of sex; in general, however, males tend to have more yellow than females. Scale-hairs of this region now brighter, straw yellow as in adult, than in preceding stadia; at maximum it is a general frosting over of entire ocular quadrangle and extending behind it over anterior thorax in a rough inverted triangle; the minimum development is a small spot around or in front of each PME and around PLE, plus a strong spot behind each PLE; these latter spots are often joined by a faint yellow bar in place of the broad triangle. Scales rimming ALE and AME ranging from rust to chrome yellow. Male has a few submarginal yellow hairs on thoracic part of carapace; this is the only stage in which they appear at all in this sex in this species; also for the only time in males there are a few yellow and white scale-hairs on upper anterior parts of femora, patellae, and tibiae of all legs; in females corresponding hairs appear only on patellae. The characteristic yellow scale-hairs and hairs of adult males first appear, although pale and sparse, in this instar on clypeus, chelicerae and palp patellae. Basal two-thirds of palps either dark or translucent in both sexes; remaining palp segments always translucent except for a few black hairs on the brownish male tarsus. Legs black except at least for coxae, trochanters and tarsi, which are all translucent horn in both sexes; in addition, basal parts of femora, patellae and distal parts of tibiae may be pale, especially in female. *Abdomen*. Both bands remain very pale, dull yellow in both sexes. Anterior band still broader than posterior, with a slight, posteriorly directed median apex; posterior continuing to have a median bulge directed forward and the ends curve forward laterally. Terminal paired spots either distinct and laterally placed or very obscure; in addition there is usually a median terminal indistinct blotch or band



TEXT-FIG. 14. Display in *C. xanthopa*. **A**, frontal view of rocking preface to threat and courtship displays; **B**, dorsal view of same; **C**, threat display; **D**, courtship, Stage I, lateral view; **E**, same, frontal view. Yellow scales indicated in color; iridescence of legs not shown.



TEXT-FIG. 15. Frontal views of adult ♀ *Corythalia*. **A**, *C. chalcea*; **B**, *C. fulgipedia*; **C**, *C. xanthopa*.

in place of simple paired spots, this terminal irregularity being typical from this instar onward.

SEVENTH INSTAR, FEMALE: Cephalothorax: Ocular quadrangle and thoracic region as in preceding stadium, the yellow scale-hairs being very variable, although in general there is less yellow than in sixth instar. Always, however, there is at least some yellow across anterior part of quadrangle, with spots traceable in front of or around PME. The thoracic region is the most variable,

the yellow ranging from a simple pair of spots behind PLE to an inverted triangle almost as extensive as in some preadult males. ALE and AME rimmed with chestnut. Clypeus with a very few yellow hairs. Palps usually translucent horn; rarely with darkened femora, tips of tarsi dark. Legs strongly banded as in preceding stage; the same segments and degree of variation are involved, though individuals are always darker in the seventh than in the sixth stage. A few yellow scales on dorsal part of fourth

emur; rest of femora, patellae, tibiae and proximal half of metatarsi with a few sparse whitish and yellowish scales, especially at joints, on all except first legs where they are practically absent; these leg scales reach maximum development for this species in this sex and stadium. Abdomen. The most characteristic feature of this stadium is the breaking down of anterior band into a semicircle of variable, asymmetrical, irregular spots. Usually three decided spots occur anteriorly, and another pair, one on each side, behind and lateral to, the outer spots; sometimes, however, the spots are indistinct and tend to merge. The second band is unbroken but slender, usually strongly V-shaped, with a decided median peak and the lateral edges curving strongly forward toward the more posterior spots. The general effect is of a broken circle occupying anterior two-thirds of abdomen. The terminal markings usually consist of a fairly continuous band, just before the spinnerets, triangular, with the apex directed forward, or it may be an arched band; it is never a simple pair of spots. Venter brown, spotted and speckled with black and with a large black irregular central marking; there are some short grayish-buff hairs, especially laterally.

SUMMARY OF COLOR DEVELOPMENT IN *C. xanthopa*.

(It must be kept in mind that Fourth Instar is unknown).

Integument. Carapace, mouthparts and sternum black in second instar, as usual. Palps remain completely translucent and pale until sixth in male, when basal part of femur may or may not darken; in female basal part of femur may darken to brown in sixth or seventh. Leg pigment develops tardily, two or three instars later than in *chalcea* or *fulgipedia*. There is no trace of

banding before fifth, and then it is present in only two out of three observed specimens. Preadult males and females (sixth and seventh instars, respectively) have the legs still pale at least proximally and distally, and often strongly banded; even the adults have all feet pale, not only the third and fourth. Integument of abdomen does not attain full blackness until third, the second, at least in early part of stage, being dark gray-brown.

Yellow hairs and scale-hairs: Throughout the instars the color yellow almost completely replaces the white and bronze of *chalcea* and *fulgipedia*, the only exception being a few whitish or bronze leg scales in the preadult instar. Carapace, like that of *chalcea*, lacking light scale hairs until third. Unlike *chalcea*, the basic pattern of dorsal carapace is two postocular spots instead of a postocular bar. In later instars, from the fifth through the seventh female, there is a considerable and highly variable amount of yellow on and immediately behind ocular quadrangle, especially concentrated around and near PME; only the latter areas survive in adults. Large eyes rimmed as usual with yellowish, varying from rust to chrome, from fifth on. Clypeus and chelicerae remain naked (except for the usual black bristles) until sixth; then the first pale yellow hairs appear on palps, face and chelicerae of male, reaching their full development a stage later in the adult. In females, a few yellow hairs appear on clypeus in the seventh only, being lost in adult. A few white and yellow leg scales in sixth only of males and in seventh only of females. Abdomen. The yellow scales are in the form of two bands and a terminal pair of spots throughout the sixth instar. The preadult (7th instar) female is unique in having the anterior band broken into spots.

STRUCTURE.

With the characteristics described on

TABLE XII.
Relative Proportions in *C. xanthopa*.

	Males		Females	
	Range %	Average %	Range %	Average %
Carapace Length: Breadth	69-75	71.8	68-74	71.0
Carapace Length: Height	57-65	60.0	55-59	56.2
Carapace Length: Oc. Quad. Length	38-49	43.2	38-44	40.4
Carapace Length: Oc. Quad. Breadth	68-75	71.2	66-68	67.2
Carapace Length: AME Diameter	20-22	21.2	19-21	19.8
AME Diameter: ALE Diameter	66-77	71.2	69-74	71.2
AME Diameter: MLE Diameter	18-20	19.2	19-21	20.4
AME Diameter: PLE Diameter	52-63	60.4	55-67	61.4
AME Diameter: Clypeus	42-50	45.4	43-52	47.3
Carapace Length: 1st Tibia	31-35	33.0	29-31	30.6
Carapace Length: 2nd Tibia	32-35	33.4	30-32	29.6
Carapace Length: 3rd Tibia	42-47	45.0	38-42	40.6
Carapace Length: 4th Tibia	45-48	47.0	42-45	43.2
Carapace Length: 1st Metatarsus	29-32	30.4	30-32	29.8
Carapace Length: 2nd Metatarsus	30-33	31.8	29-31	29.6
Carapace Length: 3rd Metatarsus	47-51	48.8	44-47	45.8
Carapace Length: 4th Metatarsus	52-57	53.6	51-54	52.2
Carapace Length: Palp	74-79	76.8	77-84	81.4

pp. 3 ff. In contrast to color development, the course of post-embryological development of structure shows no clear specific distinctions except in the relative tardiness of the appearance of some of the spines and details of tarsal claw-teeth development. With these exceptions, therefore, the discussion below concerns adults only. Ranges and averages of proportions are given in Table XII; and comparisons with the other species in Table I. In regard to development, see also pp. 4 ff.

Carapace. Height clearly more than half of length; anterior part of thoracic profile descending very gently. Ocular quadrangle broad anteriorly, especially in males. Greatest width at bulge before PLE, or width at that point equal to width at level of second-to-third coxae.

Eyes. Eyes relatively about as in *chalcea*, except that ALE and PLE are a little larger. PME slightly nearer to PLE than to ALE.

Clypeus. Slightly more than half diameter of AME.

Chelicerae. Apparently no teeth on superior margin.

Maxillae. Outer margin scarcely concave; tubercle faintly indicated.

Lip. No distinctive specific characteristics.

Sternum. Broader than in other two species, the width in both sexes being four-fifths of its length, and slightly wider anteriorly at base of lip; lateral excavations feebly developed.

Bristles. No distinctive specific characters.

Legs. Fourth leg usually longer than third in both sexes; first longer than second in both sexes in only about 60% of individuals measured. In the formula, Table XIII, the alternate order is expressed by the figures in parentheses in the upper row; figures of proportions are averages; for range of variation see Table XIII. Segments slender, as in *chalcea*. Tibial index: first leg, males 23 to 25, females 24 to 25; fourth leg, males 17 to 22, females 18 to 20.

Fourth metatarsus longer than third to a greater degree than in other two species. Iridescence feebly developed in this species, though present on same segments as in *chalcea* and *fulgipedea* on first three legs, and on corresponding segments of fourth leg in addition; there is relatively little flattening even of the strongly iridescent third and fourth tibiae and metatarsi. Fringes of first three legs also similar to those found in other two species, the segments of occurrence and relative strength being unchanged (see *ful-*

dorsal and ventral surface. The main specific difference is the presence of a well developed fringe on fourth leg; this is distinguished from that of third in having dorsal fringe composed chiefly of yellow, not black hairs and in being much longer, not shorter than ventral; tibial ventral fringe shorter than corresponding width of segment of fourth leg, although it is as thick as on third.

Spines. Adults: fewer than in other two species. The following distinctions are constant; for variables consult Table II. Femur prolateral 1, not 2, at least on first two legs; retrolaters lacking, at least on first leg. First and second tibiae: proximal ventrals always lacking. First metatarsus: proximal retrolaters always lacking. No constant sexual differences.

Young: compared with *chalcea* and *fulgipedea*, there is a lag in spine development; the spines of tibia and metatarsus which always occur in the second instar in these species (Text-fig. 2, FF, GG) not appearing in *xanthopa* until the third or later. The first and second metatarsal ventrals are not always complete even in the fifth, nor all the constant pro- and retrolaters of the same segments in the sixth. Details are as follows:

As in *chalcea* and *fulgipedea*, the femur dorsals are present in second instar, as are the metatarsal prolateral distals of first and fourth legs and the metatarsal retrolaters distals of third and fourth. The rest of the earliest appearing constants, however, do not appear in *xanthopa* until the third stadium or even later. These delayed spines are the following: tibial prolateral distals, all legs; tibial retrolaters distals, third and fourth legs; metatarsal prolateral distals, second and third legs; metatarsal ventral proximal and distals, first and second legs; metatarsal ventral distals, fourth leg. Although this group of spines usually appears in the third instar, some specimens still lack the second leg's tibial prolateral distal, while the metatarsal distals of all legs are usually weak or incomplete. The fourth instar is unknown in *xanthopa*. In the fifth instar the constant first and second metatarsal ventrals and pro- and retrolaters of the same segment are still usually incomplete, unlike the usual condition in *chalcea* and *fulgipedea*. In the sixth and seventh instars, the spines are as well developed as in corresponding *chalcea* and *fulgipedea*, allowing for specific differences except that the constant metatarsal pro- and retrolaters are not always complete even in the sixth instar.

Trichobothria; Long, Dark Bristles Short, Pale Bristles. No distinctive specific characteristics.

Tarsal Claws. First, second and third leg claws less differentiated from fourth and from young than in other two species. Table III gives comparisons with the other species.

Retroteeth almost as slender, close-set and well graduated as proteeth in both first and fourth legs; as usual there are usually one or more broad, truncate rudiments or ves-

TABLE XIII.

C. xanthopa: Leg Formula.

	4(3)	3(4)	1(2)	2(1)
Males	2.21	2.18	1.70	1.64
Females	2.07	2.01	1.56	1.55

gipedea, p. 26, for details). However, the hairs are less dense than in this species, they are scarcely developed in first leg, and there is less difference in hair length of fringes of

lges at proximal ends of series, and in individuals there may be variations of one or more teeth in either direction. In one adult female fourth leg, there were 8 completely subdermal proteeth proximal to the usual, well graduated, extruded series of 13.

Palp. (Text-fig. 9, E, F). Slender. Tibial apophysis slender, simple, non-serrated, tapering to a point which extends almost to tip of distal external loop. Ventral tibial tubercle not conspicuous, poorly chitinized, close to distal edge. Whorl of embolus occupying distal third of bulb; stylus slender, much longer than shorter diameter of whorl, tip not forked.

Epigynum. (Text-fig. 10, E, F). Horizontal extent of anterior pair of dark spots, viewed externally, less than that of posterior pair (spermathecae), and they do not quite extend to anterior edge of bean-shaped patches. In size, the epigynum is a little larger than that of *chaleea*, a much larger species.

Abdomen. No distinctive specific characters.

SIZE AND GROWTH.

MEASUREMENTS.

TABLE XIV.

C. xanthopa.

Length Ranges and Averages in mm.

Instar	Carapace Length		Total Length	
	Range	Avg.	Range	Avg.
1st	.79-.85	.83	1.44-1.73	1.54
2nd	.99-1.03	1.01	1.34-1.63	1.44
3rd	1.09-1.2	1.14	1.82-2.11	1.96
5th	1.53-1.55	1.54	2.5-3.07	2.78
6th ♀	1.74-1.95	1.86	3.26-3.84	3.56
6th ♂	1.92-2.29	2.09	2.9-3.46	3.13
7th ♀	2.02-2.22	2.14	3.55-4.13	3.91
Adult ♂	2.05-2.73	2.4	3.46-4.99	4.27
Adult ♀	2.33-2.8	2.58	4.32-5.95	5.04

Table XIV gives the extremes and averages of carapace and total lengths of all specimens of *C. xanthopa*. Table IV gives comparisons with the other species. The amount of relative growth with each instar is diagrammed in Text-fig. 11. Measurements in millimeters of the male holotype and female paratype are as follows:

Male holotype. Total length in alcohol 4.8 mm.; carapace length 2.7; carapace breadth 1.9; carapace height 1.5; ocular quadrangle length 1.0; ocular quadrangle breadth 1.9; diameter AME .55, ALE .40, MLE .10, PLE .34; clypeus height .28; 3rd patella breadth .38.

Leg	Femur	Pat.	Tib.	Metat.	Tarsus	Total
1st	1.4	.68	.85	.79	.55	4.27
2nd	1.4	.79	.92	.89	.41	4.41
3rd	1.8	.85	1.2	1.3	.62	5.77
4th	1.9	.62	1.3	1.4	.62	5.84
Palp	.72	.41	.21	—	.68	2.02

Female paratype. Total length in alcohol 4.9 mm.; carapace length 2.7; carapace

breadth 1.9; carapace height 1.5; ocular quadrangle length 1.1; ocular quadrangle breadth 1.8; diameter AME .51, ALE .36, MLE .10, PLE .34; clypeus height .22; 3rd patella breadth .37.

Leg	Femur	Pat.	Tib.	Metat.	Tarsus	Total
1.	1.2	.79	.82	.79	.44	4.04
2.	1.4	.79	.85	.79	.44	4.27
3.	1.7	.79	1.1	1.3	.55	5.44
4.	1.6	.65	1.2	1.5	.58	5.53
Palp	.68	.44	.34	—	.65	2.11

RECORDS OF INSTAR DURATION.

Egg: About 15 to 18 days (records of 2 broods). **First instar:** 12 to about 16 days (records of 3 broods); **second instar;** about 17 days; **third instar:** unknown, but more than 14 days (all examples died or were preserved before molting); **fourth instar:** unknown; **fifth instar:** the single specimen, a female, allowed to molt from this stage did so on the 18th day after capture; **sixth instar:** a reared female, 17 days; three females captured in this stage molted on 21st, 22nd and 28th days; three males on 17th, 17th and 21st after capture; **seventh instar:** total duration, three females, 22, 24 and 28 days; a fourth, already in seventh instar when captured, molted on the 24th day.

BEHAVIOR.

(Text-fig. 14; Pl. I, Fig. 4).

COURTSHIP DISPLAY.

DIAGNOSIS: *Stage 1a.* A short series of rapid, side-to-side rocking jiggles. *Stage 1b.* First legs extended forward, straight, parallel, and raised to 45° angle above the horizontal. Often punctuated with the rocking of Stage 1a. *Stage 2.* The usual forward extension of first legs to horizontal to touch female and creep over her. At no point in courtship are the decorated fourth legs used, or even visible.

DESCRIPTION: *Stage 1a.* Carapace moderately elevated, all legs touching ground; abdomen slightly pendent; palps hang down, at outer sides of clypeus. Action is an exceedingly swift rocking motion from side to side. Analyzed from motion picture film, this is seen to consist of (1) alternate shifts of the carapace to right and left and (2) a corresponding, complicated bending and shifting of the legs; those on the side of the tilted body are gathered in a forwardly-directed cluster, the femora bent up and the patellae down at strong angles; those of the opposite side are well extended laterally, the first and fourth legs serving as props fore and aft, while the second and third are variably extended, usually close together, between. A series consists of from a single pair of rocks to about four pairs; they are of such lightning speed that even a 16-mm. camera at 24-frames per second fails to stop the blur of action. The abdomen swings pendulum fashion in the opposite direction from that of the sinking of the carapace.

A series of rocks alternate with approaching zigzags.

Stage 1b. Body elevated moderately on second, third and fourth legs; first two legs directed straight out to front, parallel, and elevated to angle of 45° or more above the horizontal; palps hang down at sides of clypeus, motionless; abdomen extended straight out. This stage is often punctuated with rocking of Stage 1a, sometimes with the first legs remaining in air.

Stage 2. Typical, the first legs being lowered to the horizontal position to touch the female as she allows it and to creep over her into copulating position. There is practically no preliminary patting.

THREAT DISPLAY.

DIAGNOSIS: *Stage 1.* The identical rapid, rocking jiggle used in courtship, Stage 1a (p. 35). *Stage 2.* Body elevated high on first legs; second, third and fourth pairs all off ground, raised successively higher forming perfect fan; posing for several seconds in this position.

DESCRIPTION. *Stage 1.* Rocking. The rocking motion is less important in threat than in courtship, being almost always confined to one or two jiggles before the fan display, rarely occurring between the fan displays; once or twice I have seen it omitted altogether from threat displays.

Stage 2. Carapace supported on tips of first legs, the femora being held at right angles to body, the distal segments arching widely to touch ground far out from carapace; the other three pairs are arched successively higher and more widely, all held free of the ground, suggesting a perfect fan, and held up to several seconds in statuesque immobility. The yellow dorsal fringe of the fourth leg, as well as the pale feet of all are very conspicuous. At the height of display the tip of the abdomen often touches the ground as a prop. The palps are held motionless, their yellow-haired distal-femora, patellae and tibiae touching each other in the midline below the yellow clypeal beard; the black tarsi are often directed outward.

The aggressor advances sidewise from time to time, between fan posing, always facing his opponent, an inch in one direction an inch in the other. For this progress, the second or second and third pairs are lowered, to be raised again into rigid fan position as soon as he stops. The abdomen is never raised to the horizontal in these progressions, but is just cleared of the ground; rocking between fan displays, as has been said, occurs only rarely. Sometimes, at start of the fan phase, the third and fourth legs twitch up and down in the air, before motionless posing; in view of its rare occurrence, it seems likely that only balancing is involved, rather than a peacock-like shimmer of iridescence; on the other hand, since this vibration would seem to increase the play of iridescence, it may be a tendency being en-

couraged in the species by natural selection which has not reached its full development.

This species was seen actually to fight only once. On this occasion two males were confined much more closely than usual, in photographic cell only an inch square, under hot lights. Poison injected by his opponent's chelicerae kept one of them incapacitated upside down, for an hour, but at the end of that time he recovered fully. The second long fight started and finished so quickly that I missed seeing whether the usual aggressive display preceded it. No such behavior was ever seen in the field, or in the usual roomy observation dishes.

HABITS ASSOCIATED WITH BROODING.

Five females which molted and mated in the laboratory laid eggs on the 27th, 28th, 30th, 33rd and 39th day after molting, respectively. Only those laid on the 30th and 33rd day hatched; the parent females of these young were mated on the 9th and about the 19th day after molting, respectively. A sixth female laid eggs on the 44th day after capture as an adult; those eggs also failed to hatch. The second clutch of individual females, were, as usual, laid a few days before the young of the first clutch left the cocoon; that is, about three weeks after the first clutch was laid (two examples); a third clutch was laid by one female 35 days after the second; most of the second lot, however, failed to hatch, and none of the third, nor of the later clutches of other females.

The cocoon is typical, spun on the underside of a dead leaf, flat, with the central mass of eggs, within the fine inner sac, forming a bulge; the dimensions of the whole are about 7.5 x 9.6 mm. The eggs, numbering 14 to 21 (four perfect first clutches counted) are straw yellow (Ridgway), and measure .34-.44 mm. Eggs of later clutches range from almost normal numbers to four or five; none of these small clutches ever hatched. The period of incubation is between 15 and 18 days (two examples).

SEASONAL OCCURRENCE.

There was a decided peak of abundance at the beginning of the rainy season in both 1945 and 1946, extending roughly from mid-April to mid-May. However, the species was exceedingly scarce throughout its range in 1946, or perhaps 1945 was a season of abnormal abundance. The chief weather characteristic of early 1946 was an early and chilly wet season. Thanks to a 150-foot stretch of path along the Water Trail near the laboratory, fairly accurate counts could be made throughout each season. Maxima of around 60 were counted on a number of days early in the rainy season during 1945; the following year no more than 6 were ever counted in a single day under apparently identical conditions. Thirty minutes were used to cover exactly the same strip of ground each time, a careful watch being kept

about three feet to each side of the path, that is, to the edge of the cleared space. It was found by sifting experiments (see below) and observation that very few individuals stayed out of sight under the leaves, especially during optimum weather for the species. These conditions included a moderate amount of sun filtering through the canopy following a rainy or densely misty night. Practice made the spiders very easy to see. Curiously, very few young were observed in either year. This observation area was never disturbed by sifting, but about 20 yard-square samples, taken from time to time from adjacent, equally rich pathside leaves yielded practically no early stadia. Before the sifting, it was assumed that very young spiders in particular hunted such prey as collembola in the lower part of the litter. However, more sifting should be done in years of abundance.

HABITAT.

This species seems to be confined to semi-evergreen seasonal forest and the lower borders of montane rain forest, from 740 to 1,100 meters; the individuals at the lower levels were found in semi-evergreen seasonal riverbed intrusions into deciduous forests. They were never taken in typical samples of the latter, nor in the immoderately mist-laden slopes of the pure montane cloud forest above Rancho Grande. They are completely terrestrial, among dead leaves on edges of clearings and trails; they never occur in dense undergrowth on the one hand nor in bright, often dried areas like open roadsides on the other.

RELATIONSHIPS.

C. xanthopa does not appear to be closely related to any species so far described. The strong fourth leg fringes set it apart at once from all described Central American and West Indian *Corythalia*. *Dynamius fimbriatus* Peckham, 1900, from Brazil, has heavy fringes on all legs, but differs in most other respects. The similarity of the male clypeus decorations to those of the otherwise very different *C. canalis* (Chamberlin, 1925) is a good example of the sporadic appearance of male decorations.

MATERIAL.

A total of 116 specimens of *C. xanthopa* have been preserved, including exuviae. They are distributed as follows among the instars: the first instar, 13; second, 11; third, 4; fourth, none; fifth, 3; sixth, ♀, 5; sixth, ♂, 7; seventh, ♀, 15; adult, ♀, 28; adult, ♂, 30. All were taken within a radius of two kilometers of Rancho Grande. The following have been designated as holotype and paratype:

HOLOTYPE: Male. Cat. No. 461195, Department of Tropical Research, New York Zoological Society; Water Trail, Rancho Grande, near Maracay, State of Aragua, Venezuela; 1,100 meters; lower cloud forest; Mar. 14, 1946.

PARATYPE: Female. Cat. No. 461196, Department of Tropical Research, New York Zoological Society; same location as holotype; Sept. 2, 1946.

The name *xanthopa* is proposed in reference to the conspicuous yellow face of the male.

SUMMARY.

Three new species of *Corythalia*—*chalcea*, *fulgipedia* and *xanthopa*—are described after detailed study in the field and laboratory. All were taken on a single mountain range of the coastal Andes of Venezuela, at elevations of 700 to 1,300 meters; the niches of all the species overlapped.

Range of variation in color, measurements, proportions and integumentary structures are emphasized in each species, the course of their post-embryological development is traced and display behavior recorded. In these descriptions lie clues to the evolution of the genus and family, to the maintenance of specific barriers and to the evolution of display. Discussion of these subjects will follow in subsequent sections of this study. Here may be noted the following points of general interest to students of spider development and speciation:

1. *Specific differences*: In adults, the greatest specific distinctions occur in color and in display behavior; the principal minor differences involve size, carapace shape, leg length, form and size of palp and epigynum, presence or absence of certain spines and details of the tarsal claw-teeth. In the young, differences are confined principally to color and pattern, and to appearance time of leg pigment, certain scale groups and secondary spines.

2. *Sexual dimorphism*: Color dimorphism ranges from slight to extreme among the three, closely related species. There is little sexual difference in size, the ranges in each species overlapping. The legs, as usual, are slightly longer in the male. Aside from white or colored scales and hairs, the male secondary sexual decorations consist of flattened iridescent areas and fringes on the legs; these structures are closely correlated with display. The sexes cannot certainly be distinguished before the sixth (preadult male) instar.

3. *Instars*. There are seven instars in the male, eight in the female, each of the juvenile stadia lasting from about 12 days to almost two months; the preadult stadium is usually longest. A male and female each lived almost a year from the time of hatching. The first, second, fifth and adult instars show the greatest changes. In the first instar the carapace is about 30% of its adult length; most of the growth occurs in the late stadia.

4. *Proportions*. In the first stadium the carapace is relatively higher, and in the second lower than in the adult. The sternum is broader in early instars. *Corythalia* is unusual in having the two posterior legs longer than the first, correlated with their use in display; this trait is evident even in the first

instar, although the legs are shorter, thicker and more nearly equal at that time. The metatarsi in late stages elongate at the expense of the tarsi.

5. *Eyes*. The anlagen are unmistakably salticid in arrangement and relative size even in the first instar, and in the second are typical of the *Plexippus* group and of *Corythalia*. They are relatively slightly larger than in adults, less recurved, and project farther laterally.

6. *Integumentary structures, including pigment and scales:*

a. *Appearing in first instar*: Primary bristles of carapace and legs.

b. *Appearing in second instar*: Black integumentary pigment of carapace and abdomen; present on legs, if at all, in bands; two primary scaled bands and terminal spots on abdomen; border scales of AME; primary carapace scales (or in third instar); primary spines (all invariable in adult), including some on each spine-bearing segment, especially distally; a few trichobothria and short, pale bristles, all well distributed; tarsal claw-teeth, those of pro- and retro-series being less differentiated than in adult, and those of first legs less distinct from fourth; facial bristles complete (or in third instar).

c. *Appearing in fourth and fifth instars, or later*: Darkening of legs; highly variable secondary scalation, often including metallic bronze scales, on carapace and abdomen; highly variable scalation of legs; secondary spines, many of them variable in adult, and including certain spines on each segment; remaining trichobothria and short bristles; additional teeth on tarsal proclaws, although retroteeth are reduced, especially on anterior legs; chelicerae teeth in sixth instar or later.

d. *Appearing only in adult males*: In all species, fringes and iridescent areas on legs; in two species, complete yellow or bronze scalation of dorsal side of abdomen; in one species, long yellow facial and palp hairs (anlagen in preadult).

e. *Reduction of structures*: Both primary and secondary carapace and leg scalation of the middle and preadult instars are usually reduced or eliminated in the adult male, and sometimes in the adult female as well. Apparently the only other cuticular structures to be reduced in late instars are some teeth on the retroclaws and the primary trochanter bristle.

7. *Display*: Threat displays between rival males are distinct from courtship behavior in all species. The fringed, iridescent legs are always involved in threat display, but in *C. xanthopa* they are never used in courtship. True fighting, in which poison is injected, apparently does not occur in *Corythalia* except under rare laboratory conditions. Unlike most salticids, in all three species the first legs are less specialized than others, and are elevated only in the final stages of courtship and, sometimes, of threat display. Results of experimental work on the release mechanisms and functions of display will be recorded in a subsequent section.

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EXPLANATION OF THE PLATE.

PLATE I.

- Fig. 1. *Corythalia chalcea*. Preliminary posturing of males before threat display.
- Fig. 2. Same. Threat display, Stage I. Lower male is advancing in zigzag motion. Cf. frontal view of climax, Text-fig. 12.
- Fig. 3. Same. Courtship display, Stage II. Female is on vertical wall of box, facing away from male. The male's position, with first legs elevated and extended straight in front of him, is typical of Stage II courtship in all three species. Cf. Stage I, Text-figs. 12-14.
- Fig. 4. *Corythalia xanthopa*. Threat display, Stage I, dorsal view. Cf. Text-fig. 14C.



FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.

COMPARATIVE BIOLOGY OF SALTICID SPIDERS AT RANCHO GRANDE, VENEZUELA.
PART I. SYSTEMATICS AND LIFE HISTORIES IN CORYTHALIA.

